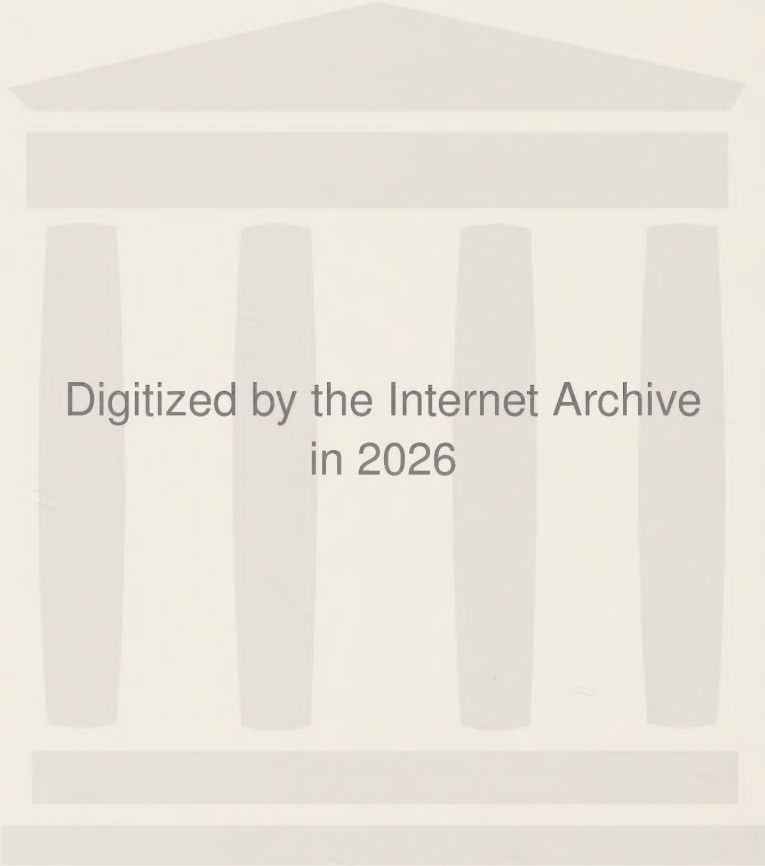


HIP SURGERY in JUVENILE CHRONIC ARTHRITIS



Brynjólfur Mogensen

Lund 1982



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HIP SURGERY IN JUVENILE CHRONIC ARTHRITIS

av

Brynjólfur Mogensen

leg läk

Lunds nation

Institutionen för ortopedisk kirurgi i Lund

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Title and subtitle Hip surgery in juvenile chronic arthritis		
Abstract Juvenile chronic arthritis (JCA) is an uncommon disease with a favourable prognosis in about three fourths of the patients. Hip involvement is often the major cause of disability and limited locomotion. During the 10-year from 1970 through 1979, 150 hip operations were performed in 73 patients at the JCA Center in Lund and the results were evaluated. Arthroscopy of the hip with a traction technique was found to give valuable information about the synovia and the cartilage surface. It should be performed early on in the course of the hip symptoms to decide about further treatment. Synovectomy was found to give long-lasting pain relief in three fourths of the patients even if performed after long-standing hip disability with narrowing of the joint space. The range of movement was not improved. Synovectomy may postpone total hip arthroplasty for several years. The outcome of soft tissue releasing operations was disappointing due to the short-lasting effect. A more extensive release combined with synovectomy might give better results. The early clinical results of surface replacement were promising but the 2-year radiographic follow-up revealed loosening in half of the hips and roentgen stereophotogrammetry showed migration in three fourths. The long-term clinical results after total hip replacement were satisfactory. However there was an actual or potential loosening in one third of the hips at an average follow-up of 6.5 years. The radiographic loose total hip arthroplasty had a slightly lower pain score. At least one revision will be necessary in most of the hip arthroplasties.		
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 Date 16 april 1982

HIP SURGERY in JUVENILE CHRONIC ARTHRITIS

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To the juvenile chronic
arthritis patient

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INTRODUCTION

Chronic arthritis in children became well-known half a century after Georg Fredrick Still's publication 1897 "On a form of chronic joint disease in children" when centralization to clinics with interest in pediatric rheumatology started.

The disease entity has been called Still's disease, juvenile rheumatoid arthritis and juvenile chronic polyarthritis. However, the European League against Rheumatism (EULAR)/World Health Organisation (WHO) Workshop "On the care of rheumatic children" in Oslo 1977 decided to use the term juvenile chronic arthritis (JCA) (47) for arthritis which begins under the age of 16 and has a minimum duration of three months, regardless of the age at which the patient was first seen. The disease should further be classified by the mode of onset into systemic illness, polyarthritis and oligoarthritis. Juvenile ankylosing spondylitis, arthropathies associated with chronic inflammatory bowel disease and psoriatic arthropathy are identified within this classification.

There are several distinct conditions that cause diagnostic confusion and should be excluded, for example: 1/ Infectious arthritis and post-infectious arthropathies. 2/ Non-rheumatological affections of the musculoskeletal system including trauma, Perthes' disease, slipped femoral capital epiphysis and coxitis simplex. 3/ Arthropathies associated with specific non-rheumatological immunological abnormalities, haematological disorders, neoplastic diseases and villonodular synovitis. 4/ Distinct conditions affecting the musculoskeletal system and connective tissue including polymyositis, dermatomyositis and systemic lupus erythematosus. 5/ Acute rheumatic fever.

The prevalence of JCA is not known and probably varies in different parts of the world (7). The prevalence in Finland is about 8/10 000

children (36) or about 5 per cent of the total rheumatoid arthritis hospital population (17, 30). The long-term prognosis for JCA is favourable as 70 to 90 per cent of the patients are in the American Rheumatoid Association (ARA) (42) functional class I or II after five to 15 years. However, 30 to 50 per cent of the patients will still have active disease (5, 10, 22, 30). The prognosis is influenced by the mode of disease onset, duration of disease activity, age at onset, rheumatoid factor, rheumatoid nodules and when the patient is seen by a pediatrician trained in rheumatology (4, 10, 17, 30). The frequency of hip involvement in patients suffering from JCA varies from one fifth to two thirds and it is often the major cause of disability and limited locomotion (4, 6, 26, 27, 37, 39).

In Sweden there are 8.3 million inhabitants and about one fifth (1.7 million) are below the age of 16. If the prevalence is the same in Sweden as in Finland or about 0.8/1 000 children then 1 400 patients below the age of 16 have JCA and at least one fifth of these have hip involvement. The care of the more severe JCA patients in Sweden is centralized to the Department of Pediatric Rheumatology, University Hospital in Lund. It is likely that a majority of the more severely disabled patients has been referred to Lund for evaluation and especially for surgical treatment. In 73 patients with JCA (age range 8-57), 150 hip procedures have been performed during the last 10-year period from 1970 through 1979 in Lund (Table I).

Table I. Surgical procedures of the hip from 1970 through 1979

Operation		Number
Major	Total hip replacement	50
	Total hip revision	4
	Surface replacement	12
	Arthroplasty (Smith-Petersen)	1
	Girdlestone	1
	Chiary osteotomy	1
	Proximal femur osteotomy	3
	Synovectomy	16
Minor	Tenotomy	26
	Extraction of osteosyntetic material	4
	Arthroscopy	12
	Mobilization in general anaesthesia	11
	Steroid injection in general anaesthesia	9
Total		150

Although hip involvement is common and one of the most disabling factors due to pain, poor range of motion often with contractures causing difficulties in the daily activities including the sex life, there are relatively few publications about the surgical treatment available and they often discuss the results of several joint procedures.

PURPOSE OF THIS INVESTIGATION

1. To describe arthroscopy of the hip and to compare it with the radiographic and surgical findings.
2. To evaluate the long-term results after hip synovectomy.
3. To evaluate the long-term results after soft tissue release operations of the hip.
4. To evaluate the early follow-up results after surface replacement of the hip.
5. To compare the clinical, radiographic and the roentgen stereophotogrammetric findings of surface replacement of the hip.
6. To evaluate the long-term results after total hip replacement.

PATIENTS, METHODS AND RESULTS

General remarks

There are numerous systems available for the evaluation after hip surgery (3) but the scoring system suggested by Merle d'Aubigné and Postel 1954 as modified by Charnley 1972 is the most common and has been used in this study for the clinical evaluation.

Table II. Numerical classification of the clinical state of affected hip joints.

Score	Pain	Range of movement	Walking
		degrees	
1.	Severe and spontaneous	0- 30	Few meters or bedridden. Two sticks or crutches.
2.	Severe on attempting to walk. Prevents all activity.	31- 60	Time and distance very limited with or without sticks.
3.	Tolerable, permitting limited activity.	61-100	Limited with one stick (less than one hour). Difficult without a stick. Able to stand long periods.
4.	Only after some activity.	101-160	Long distance with one stick. Limited without a stick.
5.	Slight or intermittent. Pain on starting to walk but getting less with normal activity.	161-210	No stick but a limp.
6.	No pain.	211-260	Normal.

The functional capacity of the patients was evaluated according to the classification of the American Rheumatoid Association (ARA) (42).

Class I. Complete functional ability to carry out all usual activities without handicap.

Class II. Functional ability adequate for normal activities despite handicap or discomfort or limited motion of one or more joints.

Class III. Functional capacity to perform only little or none of the activities of usual occupation or self care.

Class IV. Incapacitated, largely or wholly with the patient bedridden or confined to wheel-chair permitting little or no self care.

The radiograms were evaluated by the system of Larsen et al. 1977. The evaluation was made by comparing the radiogram with a standard film series based on the following definitions.

Stadium 0. The normal status of the joint. Changes not related to arthritis, for example bone deposition, may be present.

Stadium I. Slight changes. One or more of the following changes are present: periarticular soft tissue swelling, periarticular osteoporosis, and a slight joint-space narrowing.

Stadium II. Definite early changes. Small erosions and joint-space narrowing.

Stadium III. Medium destructive changes. Large erosions and joint-space narrowing.

Stadium IV. Severe destructive changes. Severe erosions and bone attrition. Bone deformation is present.

Stadium V. Mutilating changes. The original articular surfaces have disappeared. Gross bone deformation is present.

Arthroscopy of the hip in juvenile chronic arthritis (I)

During a ten-year period (1970-1979) 12 arthroscopies were performed in 10 patients with JCA and during 1980 there were three additional arthroscopies in three patients. The indication for arthroscopy was pain not relieved by anti-inflammatory drugs and/or physiotherapy. The duration of hip symptoms averaged five years (3 months to 14 years) and the mean age at the time of arthroscopy was 16 years (11 to 29 years).

The arthroscopy was carried out as an operative procedure. The patient, under maximal muscle relaxing anaesthesia, was supine on a traction table and a two plane image intensifier was used. The hip was in 10 to 30 degrees of flexion with no rotation. A needle (120 x 0.9 mm) was inserted about 3 cm proximally and 1 cm ventrally to the tip of the greater trochanter and advanced into the joint with the help of the intensifier. Thirty to 50 ml of physiological

saline was injected into the joint and the hip distracted just more than 1 cm. Through a short incision where the needle was inserted, the arthroscope was introduced with the aid of the sharp obturator in the same direction as the needle, which was withdrawn. Once through the capsule the sharp obturator was replaced by a blunt one and advanced about 1 cm into the joint and changed to the optical system with an infusion pump attached. Laterally the 30° and medially the 70° optic were used. About one third of the femoral head and one fourth of the acetabulum could always be inspected. The medial part of the joint could not be inspected. The synovium was best inspected by the 30° optic laterally. There were no complications during or after the arthroscopies nor after the operations performed in the same anaesthesia.

The synovial membrane was classified according to the following four stages: normal, mild synovitis, moderate synovitis and severe synovitis. The cartilage of the femoral head and acetabulum was classified according to four stages: normal, mild erosions (yellow areas and flaking), moderate erosions (areas with large and deep cartilage erosion), and severe erosions (erosion through cartilage to or into bone).

Comparison was made between radiograms, macroscopic findings at arthroscopy and operation independently by two surgeons. There was a good correlation between the radiograms, the arthroscopies and the operations. The findings at the arthroscopies and operations were very similar, but during the operations the synovitis was sometimes seen to be rather more florid. More information was gained with the arthroscope about the acetabular cartilage than at synovectomy.

In two patients there were great discrepancies between the arthroscopy or synovectomy findings and the radiograms. The greatest difference was in a patient with juvenile psoriatic arthropathy who

had severe erosions both on the femoral head and in acetabulum but the radiograms revealed stadium I. The other patient appeared to have advanced radiographic changes (stadium III) in both hips but at arthroscopy and operation of the right hip only mild cartilage changes were found. In the third patient there were discrepancies in the medial part of the joint between the operative and the radiographic findings but the medial part of the hip joint can not be inspected by the arthroscope.

Synovectomy of the hip in juvenile chronic arthritis (II)

Sixteen synovectomies of the hip in 14 patients with JCA were performed during the ten-year period 1970-1979 and two during 1980. Pain was the main reason for synovectomy in 15 hips, subluxation and pain in two hips and poor mobility in one.

The duration of the disease averaged 7 years (range 1-19 years) and the duration of the hip symptoms 5 years (range 1-19 years). The mean age at the time of synovectomy was 14 years (range 8-29 years) and the average follow-up time was 52 months (range 6-108 months).

The mode of disease onset was systemic illness in six patients, polyarthritis in six and oligoarthritis in four. At follow-up 13 of the patients had polyarthritis and three oligoarthritis. Fifteen of the patients were using or had used steroids alone or in combination with other major anti-inflammatory drugs before the operation. The disease activity was evaluated pre- and postoperatively and a four stage classification was used. The first 16 synovectomies were performed through a lateral approach (15), and the last two through an anterior approach (41) and the hips were dislocated to enable total synovectomy.

The operative cartilage findings correlated well with the preoperative radiograms in 14 hips. In two hips the cartilage erosions were more extensive at operation than as revealed by the radiograms

and vice versa in one hip. None of the operated hips were normal on the radiograms before the operation. Before the operation eight hips were radiographically in stadium I or II and seven in stadium IV or V. At follow-up four hips were in stadium I or II and 13 hips were in stadium IV or V. Those who progressed during the last two years before the synovectomy progressed further with three exceptions. Half of the not operated hips had progressed radiographically at follow-up.

The pain relief was very satisfactory. The pain score was on average 2.4 points before the operation, 5.1 at discharge from hospital and at follow-up 4.4 points. The pain in the non-operated hip was before the operation 4.8 points and 4.1 points at follow-up. Four patients were dissatisfied because of poor or not lasting pain relief and one because of poor hip mobility. Four of the five had active disease before and after surgery. The total range of movement improved slightly after surgery but was the same at follow-up as before the operation. The 12 patients who had flexion contractures followed the same pattern. The walking capacity and the ARA (42) score was almost unchanged before and after surgery.

At follow-up three prosthesis operations had been performed on both the operated and the unoperated side and altogether 4.4 operations had been performed on each patient.

Soft tissue release of the hip in juvenile chronic arthritis (III)

Soft tissue releasing operations for hip contractures were performed in 18 patients with JCA during a 10-year period (1970-1979). Seventeen patients (25 hips) could be evaluated and the average follow-up time was 48 months (range 2-111) with a minimum of two years in the patients not reoperated. The indications for surgery were severe hip contractures in spite of intensive physiotherapy and adequate anti-inflammatory drug treatment.

The patients had had their disease for about eight years (range 1-28) and their hip symptoms for about seven years (range 1-26). The average age at operation was 14 years (range 8-30 years). The mode of disease onset was oligoarthritis in nine patients, polyarthritis in two and systemic illness in six patients. At follow-up three patients had oligoarthritis and 14 had polyarthritis.

Adductor tenotomies (A) (all clinical contracted adductor muscles) were performed in 10 hips, subspinal tenotomies (S) (sartorius, tensor fasciae latae, rectus femoris) in nine hips, and adductor tenotomies combined with subspinal tenotomies (AS) in six hips.

The flexion contractures in the whole material were decreased by surgery from an average of 28 to 18 degrees after one month and were almost unchanged at one year but had increased to the preoperative level at an average follow-up time of 48 months (range 2-111 months). The maximal range of abduction and the total range of movement followed the same pattern. The preoperative radiograms revealed moderate changes.

The disease activity did not apparently affect the final results and more than half of the patients were treated pre- and postoperatively by steroids or steroids in combination with other major drugs. The patients were relatively painfree before and after surgery.

Three patients (four hips) considered the releasing operation worthwhile but all the others were negative due to insignificant gain and the short-lasting effect. At follow-up 13 of the hips had been reoperated, eight of these with prosthesis.

Surface replacement of the hip in juvenile chronic arthritis (IV + V)

Surface replacement of the hip was performed in 13 patients (17 hips) with chronic arthritis and long-standing hip disability from April 1978 to October 1979. Eight patients (12 hips) had JCA. The

average age at the time of surface replacement was 23 years (range 14-43 years).

All the operations were carried out through an anterior approach (41). In eight of the hips there was total motion of less than 30 degrees with flexion deformities up to 60 degrees. Valgus deformity and increased anteversion together with the flexion contractures necessitated increased release with tenotomy not only on the ventral but also on the dorsal side and, in most cases, of the iliopsoas.

All the patients were evaluated clinically and radiographically at least once on average 22 months (range 7-30 months) after the surface replacement. Nine patients (11 hips) were further evaluated twice by roentgen stereophotogrammetry and the results compared with the radiographic changes and the clinical results. A third clinical evaluation of the not reoperated patients in the stereo group was made at an average of 35 months (range 27-44 months) after the surface replacement.

The early clinical results were promising concerning the pain relief, range of motion and walking capacity. Seven of the eight patients could enjoy their sex-life after the arthroplasty and the patients were also generally more independent in their daily living. At the third clinical follow-up the pain score had decreased and two hips had been reoperated, one because of femoral cup loosening which was in 10 degrees of varus from the beginning. In the other the acetabular socket was replaced because of painful loosening. This patient had severe acetabular protrusio prior to the operation and had a minor central acetabular fracture during the operation. Two more developed hip pain and the pain score was three and four, at follow-up.

The acetabular socket was considered loose if there was a radiolucent zone of more than 2 mm locally or all around the socket.

The femoral socket was considered loose if there was a change in the original position. In the whole group (15 hips, reoperated hips excluded) there were radiographic changes in five hips. In one acetabular socket there was a radiolucent zone of 5 mm medially and the socket had rotated into a more vertical position, and another acetabular socket had migrated upwards about 5 mm. Two femoral cups slipped into varus and in one hip both components were considered loose.

In the roentgen stereophotogrammetric investigation the expected overall accuracy of about 0.1 mm along the X-, Y- and Z- axes could not be obtained due to insufficient spreading of the bone indicators. Only values exceeding 0.5 mm along the vertical Y- axis were considered to represent true movements. In the 11 hips evaluated twice by roentgen stereophotogrammetry all but one acetabular socket, which was unstable at the first examination, were stable at both examinations and five sockets had migrated 1.1 to 2.7 mm. Six femoral cups subsided 1.1 to 2.2 mm but none was symptomatic. Eight of the hips showed migration of one or both of the components and five of these were also considered loose as revealed by the radiograms and the roentgen stereophotogrammetric analysis (reoperated hips included).

Total hip replacement in juvenile chronic arthritis (VI)

During the past ten years (1970-1979) 50 total hip replacements (THR) have been performed in 33 patients with JCA and long-standing hip disability. The average age of the patients at operation was 26 years (range 15-51 years). Pain and/or poor motion was the main indication for THR in 36 hips, and severe contractures and poor motion for another 14 hips.

Twenty-eight operations had been performed previously in 24 hips. For patients with severe bilateral hip and knee contractures, the special lay-up technique of the patient on the operation table was

needed 11 times using an unsterile assistant according to McKee-Farrar with minor modifications (34). Nine hips were clinically ankylotic and soft tissue release was necessary in two fifths of the THR to correct flexion and/or adduction deformities. It was necessary to use a custom-made prosthesis designed for JCA 16 times because of a small femoral diameter. There were anaesthetic difficulties in about one fourth (14/50) of the patients and half of these could not be intubated.

The average clinical follow-up was 77 months (range 13-140 months) and the shortest follow-up time was 24 months for the patients who were not reoperated. The overall clinical results were appreciated by the patients. All but two were satisfied with the primary THR at follow-up and five of the six with revision arthroplasties. Only one of the not reoperated patients was dissatisfied with the pain relief at follow-up. The grade of pain was on average 2.7 points before the THR and at follow-up 5.3 points. There was a satisfactory increase in the total range of movement (on average 1.8 points prior to THR to 4.5 points after) and decrease of the flexion contractures (on average 30° prior to THR to 6° after) at follow-up. Walking was only moderately improved as all had polyarthrititis at follow-up but the patients considered the improvement very important. The ARA (42) score was almost unchanged but on average eight operations had been performed on the patients at follow-up. Nineteen of the patients had tried to have an active sex-life before the arthroplasty but 16 had problems due to pain, stiffness or both. All but one were more satisfied with their sex-life after the THR.

Four hips have been reoperated due to the clinical loosening, in three of these the acetabular cup was loose. There was one proven and one suspected deep infection, both were reoperated with good results at 55 and 31 months later.

In four fifths of the hips there were advanced radiographic changes

prior to THR and in 17 there were either protrusio acetabuli or lateral subluxation of the femoral head. Protrusio acetabuli and lateral subluxation prior to THR increased the risk of acetabular cup migration and loosening. Five of the six hips with lateral subluxation preoperatively were either reoperated or radiographically loose at follow-up. Two fifths of the femoral stems were cemented in varus. In 17 hips the cement cover was insufficient especially distally. The radiograms revealed a radiolucent zone of more than 2 mm in five out of 15 hips (infected hips excluded) and 13 of these were in varus. Altogether in ten hips one or both of the components were radiographically loose at follow-up and these hips had a lower pain score (5.2) than the radiographic normal THR (5.7).

DISCUSSION

Natural history

Involvement of the hip is a major cause of disability in JCA. Acetabular dysplasia, coxa magna, coxa valga and subluxation is a common feature in JCA below the age of ten. Protrusio acetabuli dominates later especially in the seropositive children. Altogether subluxation and protrusio may occur in about half of the involved hips. About three fourths had joint-space narrowing after five years of hip symptoms. Contractures are frequent and develop rapidly once the inflammatory process begins (4, 26, 27, 37). When the disease involves the hip it is of utmost importance to instruct the patient and the parents about daily contracture prophylaxis and to stress regular supervision, as hip contractures lead to knee contractures and vice versa. Unless physiotherapy and anti-inflammatory drugs have relieved the hip pain within a few months surgical intervention should be considered

Arthroscopy

The first arthroscopy was performed on a cadaver knee by Takagi 1918 using a cystoscope, and on the cadaver hip by Burman 1930. Today the arthroscope is universally accepted as a valuable diagnostic and therapeutic instrument in the treatment of knee disorders. Arthroscopy has also been performed for diagnostic purposes on other joints, including the hip joint though this is an unusual procedure (46). However, so far there is no available detailed description of how to carry out the arthroscopy and on what indication. Arthroscopy of the hip, as we have performed it, is technically feasible, is a minor operation and the patient can be mobilized immediately afterwards. It gives good information about the cartilage surface and the synovia in the lateral part of the joint and should therefore be carried out early in the course of the hip symptoms to decide about further treatment. Arthroscopy should also be performed when

the diagnosis is uncertain and at the same time biopsies can be obtained for microscopic analysis.

Synovectomy

Synovectomy of the hip is a rare procedure in JCA, only a few cases have been reported and its value is highly controversial. Due to the continuous radiographic deterioration Arden & Ansell (1978) felt that THR would ultimately give better results. However, the same authors said that synovectomy of the knee in JCA had a definite place in the overall management of JCA as after an average follow-up of five years three fourths were rated good or excellent. Garrett & Campbell (1971) and Albright et al. (1975) performed synovectomy in six, respectively nine hips after long-lasting disability. Most of our synovectomies were performed several years after the hip symptoms started and all had joint-space narrowing at the time of surgery. The reason why there are so few operations reported and why there is such a delay before the operation is probably that hip arthrotomy for diagnostic purposes is a large operation, the hip arthroscopy technique has not been available and the synovectomy results uncertain. There has therefore been a tendency to wait and see if spontaneous remission of the hip disability occurs.

The early results of Garrett & Campbell and Albright et al. were promising. Only one of Garrett & Campbell's patients was not pain relieved and cup arthroplasty was performed one year later. All the patients were improved postoperatively in the report by Albright et al. but in no instance did a normal joint result. Both felt that synovectomy was indicated in spite of the radiographic deterioration after surgery. It is reasonable to believe that our good and lasting pain relief (52 months) in spite of continuous radiographic deterioration had been even better with an intact cartilage than with moderate and severe erosions. We have used the arthroscope increasingly during the last 10-year period and it is now a routine part in the treatment of the hip disability to decide about further surgery.

Soft tissue release

Soft tissue release to decrease joint contractures and increase the range of motion is one of the basics in orthopaedic surgery. The few publications on soft tissue releasing operations in JCA (21, 28, 29) stand in clear contrast to the large number available about this procedure for deformities due to other causes; this could reflect disappointing results not mentioned by others.

The patients in our study had passed the stage of hip pain and developed relatively painfree hip contractures and had also moderate radiographic changes at the time of surgery. The results of the tenotomies were disappointing. The immediate postoperative improvement was short-lasting. A more extensive release would perhaps give better results (29) especially if combined with synovectomy. In the painful hip a careful radiographic analysis and arthroscopy could give valuable preoperative information. An early synovectomy might prevent development of the hip contractures. In the painfree contracted hip with inactive synovia only soft tissue release is necessary.

Hip replacement

Smith-Petersen performed the first vitallium mold arthroplasty 1938 but the method is not suitable today for rheumatoid arthritis patients due to the prolonged postoperative rehabilitation period and early revision or failure rate in one third of the hips (8, 32). A new era of hip surgery started with Charnley's cemented low friction total hip prosthesis in the sixties (13). Due to the early promising results there has been a tendency to perform THR in young and very disabled patients but the subject is controversial due to the uncertain long-term results (40).

In the study by Colville and Raunio (1979) of 50 Charnley prosthesis in JCA with a follow-up time of 30 months the clinical results were

very good as all the patients were painfree and only two had a total range of hip movement less than 100 degrees. There were only six pre- or postoperative complications but no infections or loosening. However, Chandler et al. (1981) have recently reported in a 5-year follow-up study of 33 THR in patients under the age of 30 actual or potential loosening in half of their patients; acetabular loosening occurred more than twice as frequently as the femoral loosening. Previous mold arthroplasty was one of the detrimental factors.

The overall clinical results of the THR in this study with an average follow-up of 77 months were appreciated by the patient as being "one of the best things that has happened in their lives". However, besides the six reoperated hips there were also ten radiographic loosening which had slightly lower pain scores, indicating an increasing failure rate with time.

The survival of THR as analysed by Dobbs (1980) indicated that after 20 years the probability of survival was about one third for the metal-on-metal prosthesis and three fourths for the metal-on-plastic prosthesis. The predominant reason for failure was loosening and the annual reoperation rate tended to increase with time. Long-term results after revision arthroplasty due to mechanical loosening or infection are not available but a short-term follow-up indicates that the results are significantly worse than those after primary arthroplasty (38).

Surface replacement with the double cup was developed during the seventies (19) as a time-gaining alternative for younger patients with hip disability; in the event of failure THR could be used as a salvage procedure. The early results with surface replacement were promising, approximating the THR results (45) and this encouraged us to start. Head (1981) reported recently a failure rate in one third of the Wagner arthroplasties mostly on the femoral side

after a follow-up time of one to four years. Trentani & Vaccarino (1981) did not recommend the Paltrinieri-Trentani surface replacement arthroplasty for patients with severe rheumatoid arthritis as half of the cases had failed after four to eight years mainly on the femoral side.

Amstutz (1982) still believes that the surface replacement concept is sound and that resurfacing will become a permanent part of the orthopaedic armamentarium. He had seven per cent loosening and two fractures in 300 hips with a follow-up time of 2-6.5 years. Fifteen per cent of his first 100 arthroplasties were in rheumatoid arthritis and none had loosened. He recommends the procedure only for patients over 40 years with a good bone stock, but does not regard chronic arthritis as a contra-indication. He also stresses the significantly higher number of complications in the first operated hips before the surgeon has become confident with the technique.

Our early clinical results after surface replacement were promising where 16 out of 17 hips were pain relieved. However, for the 11 hips reported here with a longer follow-up time, the radiographic results are alarming as five hips were radiographically loose and eight had migrated as revealed by roentgen stereophotogrammetry. At the third clinical follow-up at an average of 35 months, two hips had been re-operated and two had developed hip pain. We still believe that surface replacement is of value especially in the very young arthritic patients. However, severe acetabular protrusion, fixed flexion contracture of more than 45 degrees, severe valgus and/or increased anteversion are now being operated with total hip prosthesis.

The surgical technique and the prosthetic design has changed during the last few years for both the surface replacement and total hip prosthesis. Better results may be achieved with thorough cleaning of the bone surface, plugging of the femoral canal and pressurization of the cement. Metal backing of the thin acetabular socket

will decrease the stress forces at the bone cement interface and eventual loosening, and the use of multiple burr holes in the acetabulum will increase cement fixation. A modern femoral stem design and a better positioning of the components will also help (18, 23, 24, 33). Both the patient and the surgeon should, however, be aware of the fact that in JCA at least one revision arthroplasty will be necessary and that restriction of physical activity will add to the prosthetic survival.

JCA Centers

Considering the magnitude of the JCA problem and that multidisciplinary approach is necessary, it is of great importance that the relatively few patients with JCA, especially those who are to be operated upon in a population of eight million, as in Sweden, should be concentrated to a trained team of rheumatologists, physiotherapists, radiologists, orthopaedic surgeons and anaesthesiologists. Hip surgery generally relieves the symptoms and increases the quality of life in most patients with JCA and hip symptoms but it does not provide a cure of the progressive disease.

CONCLUSIONS

1. Arthroscopy of the hip performed with the traction technique is technically easy to perform and gives good information about the synovia and the cartilage in the lateral part of the joint. It should be performed early in the course of hip disability in JCA.
2. Synovectomy of the hip gives long-lasting pain relief in three fourths of the patients even if performed after long-standing hip disability but the hips continue to deteriorate as revealed by radiograms. However, hip arthroplasties can be delayed for several years. There is no increase in the range of movement.
3. Soft tissue release of the hip performed after long-standing hip contractures is disappointing as the patients had the same range of movement at follow-up.
4. The early clinical results were promising after surface replacement but follow-up at 35 months revealed a high actual or potential failure rate in half of the patients. Conventional radiograms give the information needed in the daily routine but roentgen stereophotogrammetry is superior in the evaluation of early migration.
5. The long-term clinical results were satisfactory after THR but due to an actual and potential failure rate in one third at 77 months, revision arthroplasty will in time be necessary for most of the patients.

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ARTHROSCOPY OF THE HIP IN JUVENILE CHRONIC ARTHRITIS

by

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Arthroscopy of the Hip in Juvenile Chronic Arthritis

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Summary: After distension of the hip joint with physiological saline followed by traction, hip arthroscopy was performed in 13 patients (15 hips) with juvenile chronic arthritis. Arthroscopy gave better information about the cartilage than the roentgenograms and gave the same information about the synovial membrane as the operation. This diagnostic procedure should be performed early in the course of hip disability. **Key Words:** Juvenile chronic arthritis—Hip arthroscopy.

The first arthroscopy was performed on cadaver knee by Takagi in 1918 using a cystoscope (24), and the first clinical report was published by Bircher in 1921 (3).

Arthroscopy is now accepted as a valuable diagnostic aid in the treatment of especially traumatic knee disorders (13,24). Arthroscopies are also performed, although not frequently, in other joints (7,8,24,26). Arthroscopy of the hip is not generally accepted and only a few published reports are available (4,6,22,23,24,26). Indications and the technical performance are not described.

The aim of this paper is to present our indications and technique for arthroscopy of the hip in juvenile chronic arthritis (JCA).

PATIENTS AND METHODS

During the past 10 years (1970-1979), 12 consecutive arthroscopies of the hip (10 patients) have been performed at the Department of Orthopaedic Surgery and Rheumatology, University Hospital, Lund. During 1980, there were three additional consecutive arthroscopies in three patients. Pain not relieved by anti-inflammatory drugs and/or physiotherapy was the indication of

the arthroscopy. Eleven hip operations were performed after the arthroscopies.

All 13 patients had JCA (25). The definition of JCA is arthritis with onset before the 16th birthday and a disease duration of at least 3 months, regardless of the age at which the patient was first seen. Juvenile chronic arthritis includes juvenile rheumatoid arthritis, juvenile ankylosing spondylitis, psoriatic arthropathy, and arthropathy associated with inflammatory bowel disease.

Nine of the JCA patients were classified as juvenile rheumatoid arthritis (JRA) (5). The definition of JRA is: (a) Polyarthritis (two joints or more) or monoarthritis of more than 3 months' duration. Swelling of joint must be present to fulfil the criteria of two or three features (heat, pain, and tenderness or limitations of motion). (b) Polyarthritis for more than 6 weeks but less than 3 months requires one of the following manifestations for diagnosis: rash of rheumatoid arthritis, rheumatoid factor, irido cyclitis, cervical vertebral involvement, pericarditis, tenosynovitis, intermittent fever, and morning stiffness.

Six of the JRA patients had poly-, two oligo-, and one monoarthritis.

One of the JCA patients developed a juvenile psoriatic polyarthropathy (16), and another with oligoarthritis developed a juvenile ankylosing spondylitis (21). Two patients had oligoarthritis.

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TABLE 1. Comparative findings of roentgenogram, arthroscopy, and operation

Examination No.	Sex/age	JCA subgroup	Side	Roentgenogram	Synovial membrane		Femoral head		Acetabulum	
					Arthroscopy	Operation	Arthroscopy	Operation	Arthroscopy	Operation
1	F/12	JRA polyarthritis	Right	Stadium II early epiphyseal closure	Normal	Not operated	Normal	Not operated	Mild erosions	Not operated
2	M/15	JRA polyarthritis	Right	Stadium III flattening of the femoral head	Moderate synovitis	Moderate synovitis; synovectomy	Mild erosions	Mild erosions	Mild	Not inspected
3	F/12	Same patient as No. 1	Right	Stadium II early epiphyseal closure	Severe	Severe; synovectomy	Normal	Mild	Mild	Not inspected
4	M/15	Same patient as No. 2	Left	Stadium III flattening of the femoral head	Severe	Severe; synovectomy	Severe	Severe	Severe	Not inspected
5	M/23	JRA polyarthritis	Left	Stadium V	Moderate	Moderate; total hip arthroplasty	Severe	Severe	Severe	Severe
6	M/14	JRA monoarthritis	Left	Stadium I	Severe	Severe; synovectomy, tenotomy	Mild	Mild	Mild	Not inspected
7	F/29	Juvenile psoriatic polyarthropathy	Left	Stadium I	Moderate	Moderate; synovectomy	Severe	Severe	Severe	Not inspected
8	M/11	JRA oligoarthritis	Right	Stadium II	Severe	Severe; synovectomy	Moderate	Moderate	Moderate	Not inspected
9	F/12	JRA polyarthritis	Left	Stadium II	Severe	Not operated	Moderate	Not operated	Moderate	Not operated
10	F/14	JRA polyarthritis	Right	Stadium I flattening of the femoral head; early epiphyseal closure	Severe	Not operated	Mild	Not operated	Mild	Not operated
11	F/13	JRA oligoarthritis	Left	Stadium II	Severe	Tenotomy	Moderate	Moderate	Moderate	
12	F/15	Oligoarthritis	Left	Stadium I, mainly medially	Mild	Tenotomy, intraarticular steroids	Normal	Normal	Normal	
13	F/17	Oligoarthritis	Right	Stadium 0	Mild	Not operated	Normal	Not operated	Normal	Not operated
14	F/17	Juvenile ankylosing spondylitis Oligoarthritis	Right	Stadium II, mainly medially	Mild	Mild; Surface replacement	Mild	Severe medially	Mild	Severe medially
15	F/13	JRA polyarthritis	Left	Stadium III	Severe	Severe; synovectomy	Moderate	Moderate	Mild	Moderate

The duration of disease averaged 7 years (range, 10 months to 19 years) and the hip duration 5 years (range, 3 months to 14 years). The mean age at the time of arthroscopy was 16 years (range, 11 to 29 years).

Standard frontal and lateral roentgenograms were taken preoperatively with the patient in supine position. The roentgenograms were evaluated according to Larsen et al. using a six graded scale (17).

The evaluation is made by comparing the roentgenogram with a film series based on the following definitions.

Stadium 0. The normal status of the joint. Changes not related to arthritis, for example bone deposition, may be present.

Stadium I. Slight changes. One or more of the following changes are present: periarticular soft tissue swelling, periarticular osteoporosis, and a slight joint space narrowing.

Stadium II. Definite early changes. Small erosions and joint space narrowing.

Stadium III. Medium destructive changes. Large erosions and joint space narrowing.

Stadium IV. Severe destructive changes. Severe erosions and bone attrition. Bone deformation is present.

Stadium V. Multilating changes. The original articular surfaces have disappeared. Gross bone deformation is present.

Changes especially related to JCA are described separately (Table 1).

At arthroscopy and eventually operation, the synovial membrane was classified according to the following four stages: normal, mild synovitis, moderate synovitis, and severe synovitis. The cartilage of the femoral head and acetabulum was classified according to four stages: normal, mild erosions (yellow areas and flaking), moderate erosions (areas with large and deep cartilage erosions), and severe erosions (erosion through cartilage to or into bone). Comparison was made between roentgenograms, macroscopic findings at arthroscopy, and operation independently by two surgeons.

TECHNICAL REMARKS

The arthroscopy was carried out as an operative procedure. The patient, under maximal muscle relaxing anaesthesia, was supine on a traction table (KIFA), and a two plane image

intensifier was used. The hip was in 10 to 20° of flexion with no rotation. In some cases, greater distraction was achieved with the joint in 30° of flexion. A needle (120 × 0.9 mm) was inserted about 3 cm proximally and 1 cm ventrally to the tip of the greater trochanter. The position was followed through the intensifier when the needle was advanced into the joint (Fig. 1). Injection into the joint of 30 to 50 ml of physiological saline was carried out, and the hip was distracted just more than 1 cm (Figs. 2 and 3). Through a short incision where the needle was inserted, the arthroscope (Storz 5 mm) was introduced with the aid of the sharp obturator in the same direction as the needle, which was withdrawn (Fig. 4). Once through the capsule, the sharp obturator was replaced by a blunt one and advanced about 1 cm into the joint and changed to the optical system with an infusion pump (Sarns 5500) attached. The flow through the joint averaged 30 ml/min (physiological saline). Laterally the 30° and medially the 70° op-



FIG. 1. The use of a two-plane image intensifier, the position of the patient on a traction table, and needle insertion are shown.

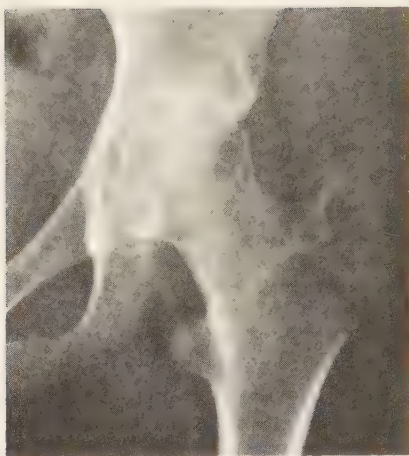


FIG. 2. Roentgenogram shows the left hip (Stadium III) in a 13-year-old girl with juvenile rheumatoid arthritis, before hip joint distraction.

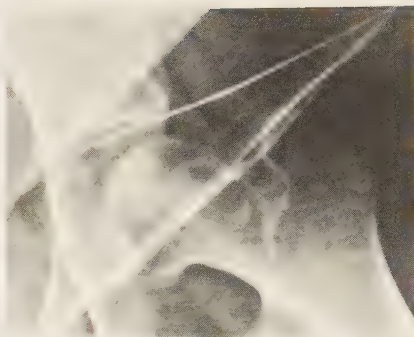


FIG. 3. Forty milliliters of physiological saline has been inserted through the needle, traction has been applied, and the hip joint has been distracted.

tic were used. The femoral head was first inspected, and by rotating the leg a greater amount of the surface was shown. The acetabulum was then inspected and in some cases ligamentum teres could be seen with the 70° optic. About one-third of the femoral head and one-fourth of the acetabulum could always be inspected (Fig. 5). The medial part of the joint cannot be inspected.

The synovium was best inspected by the 30° optic laterally, and if necessary biopsies for microscopic investigation were taken with a separately inserted biopsy forceps.

A standard arthroscope was preferred because the needle arthroscope was found to be too weak for this procedure.

The synovectomies were performed through an anterolateral approach and the anterior capsule was removed. The femoral head was dislocated in three operations (Cases 5, 14, and 15), allowing a complete inspection of the acetabular cartilage and the femoral head. There were no complications during or after the arthroscopies nor after the operations performed under the same anaesthesia or some weeks later.

RESULTS

The correlations between the roentgenograms, the arthroscopies, and the operations are shown in Table 1. The findings at the arthroscopies and operations are very similar, but during the operations the synovitis was sometimes seen to be rather more florid. More information was gained with the arthroscope about the acetabular cartilage than at synovectomy.

In two patients there were great discrepancies between the arthroscopy or synovectomy findings and the roentgenograms as shown in Table 1. The greatest difference was in a patient with juvenile psoriatic arthropathy (No. 7) who had severe erosions both on the femoral head and in acetabulum but the roentgenograms showed Stadium I. The other patient appeared to have advanced roentgenological changes (Stadium III) in both hips but at arthroscopy and operation of the right hip (No. 2) only mild cartilage changes were found.

The parents of one patient (No. 10) did not allow synovectomy despite extensive synovitis at arthroscopy.

In one patient (No. 9), an abnormal bleeding tendency was noted at arthroscopy. Tenosynovectomy of the hand a few days later revealed the same condition. A large haematoma had to be evacuated from the hand and the wound healed by granulation. It was decided not to perform synovectomy of the hip.

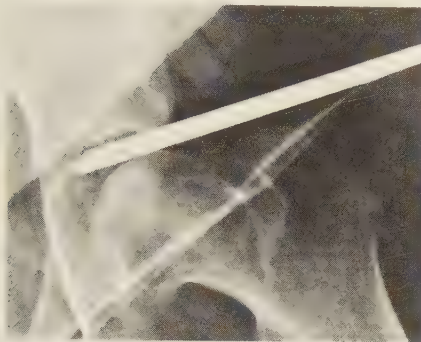


FIG. 4. The 70 mm Storz arthroscope is seen in the hip joint.

One patient (No. 11) with severe synovitis and moderate erosions was not synovectomized because the surgeon judged the result of hip synovectomy to be too uncertain.

CASE REPORTS

Case 1

A 14-year-old boy (No. 6) with monoarthritis of the left hip since 1 year suffered from severe pain all the time and used crutches. Progression from Stadium 0 to Stadium I was noted on the roentgenograms. Two intraarticular steroid injections were given with no effect. Arthroscopy of the hip was performed and because of severe synovitis and mild cartilage changes it was decided to perform synovectomy. Adductor tenotomy was performed at the same time. The patient was totally pain free after the operation, and at follow-up 5 years later he was still pain free and satisfied. There was no further progress on the roentgenograms.

Case 2

A 17-year-old girl (No. 14) with oligoarthritis since the age of 9 developed a juvenile ankylosing spondylitis (HLA-B27 positive) and 1 year previously diabetes mellitus. From the beginning, the patient had a mild hip disability, but during the last 4 months she suffered from severe hip pain and was bedridden the last 2 months



FIG. 5. Part of the femoral head and acetabulum is shown with mild erosions and cartilage flaking from the acetabulum.

before arthroscopy. Traction and antiinflammatory treatment gave no result. Roentgenograms at the time of arthroscopy showed Stadium II changes medially both on the femoral head and acetabulum. Arthroscopy showed only mild synovitis and cartilage changes proximally and laterally (Fig. 5), but it was not possible to inspect the joint medially. The patient was operated on 3 weeks later through a Smith-Peterson approach, and the femoral head was dislocated. The patient had severe erosions medially on both the femoral head and acetabulum. Surface replacement was performed, and the patient was immediately relieved from pain and mobilized with crutches after 1 week.

DISCUSSION

Hip involvement in juvenile chronic arthritis is the main reason for decreased activity in daily living (2, 14).

Careful repeated analyses of the progress of the disease, pain, mobility, and roentgenograms have up to now been used in planning the treatment. The erosions caused by JCA usually confined to the cartilage are often local and seldom reach the bone because of the relative thickness

of joint cartilage in children. An almost normal roentgenogram therefore does not exclude severe erosions of the cartilage (20).

We used the evaluating system of roentgenograms developed by Larsen et al. The system, developed for rheumatoid arthritis, is used because no better one is available for evaluating the joint space in JCA patients.

Compared with arthrotomy, arthroscopy of the hip is a minor operation but should not be attempted until one has experience with routine arthroscopy such as in the knee. Hip arthroscopy should be performed early on in the course of the disease with minimal roentgenographic changes and before advanced cartilage erosion develops (Case 1). If needed, early synovectomy can be performed when the result will probably be better (1,4,9,10,11,12,15,18). In patients with severe erosions, a surface replacement can be performed with promising early results (19).

One should be aware of the limited inspection possibilities of the medial part of the joint (Case 2). One-third of the femoral head and one-fourth of the acetabular cartilage can always be inspected. For diagnostic purposes, synovial biopsies can be taken either through the arthroscope or with a separately inserted biopsy forceps.

Arthroscopy of the hip has also been performed on adults with nontraumatic hip pain of unknown causes, and there has been no difficulty in gaining access or in inspecting the joint cavity.

Patients with JCA are often severe anaesthesiological problems, and the arthroscopist should be prepared for further surgery in the same anaesthesia. However, it is preferable that eventual hip replacement is performed within a few weeks.

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SYNOVECTOMY OF THE HIP IN JUVENILE CHRONIC ARTHRITIS

by

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ABSTRACT

Eighteen synovectomies of the hip in 16 patients with juvenile chronic arthritis were performed with satisfactory relief of pain in 13 hips. The average age at operation was 14 years and the follow-up time 52 months. The mobility and walking capacity were not changed by operation but progress as shown by radiographs before synovectomy continued for most patients. Synovectomy may relieve pain permanently and should always be considered before any prosthetic replacement.

INTRODUCTION

Synovectomy of the hip in juvenile chronic arthritis (JCA) is an uncommon procedure and its value is uncertain. Few reports are available and the number of patients is small (Fink et al. 1969; Eyring, Longert and Bass 1971; Garrett and Campbell 1971; Granberry and Brewer 1974; Isaacson 1974; Albright, Albright and Ogden 1975; Brattström and Holgersson 1978; Jakubowski 1978; Neumann and Weber 1978). The aim of this study is to describe the technique and to present the late results after 18 synovectomies of the hip for JCA.

PATIENTS AND METHODS

During the 10-year period (1970-1980) 18 synovectomies of the hip were performed on 16 patients at the University Hospital, Lund. Pain was the main indication in 15 hips, subluxation and pain in two hips (Cases 1 and 17) and marked stiffness in one (Case 15). All 16 patients had juvenile chronic arthritis (Wood 1978) defined as an arthritis which had started before the sixteenth birthday and continued for at least three months, regardless of the age at which the patient was first seen. JCA, therefore, includes juvenile rheumatoid

arthritis, juvenile ankylosing spondylitis, psoriatic arthropathy and arthropathy associated with inflammatory bowel disease. The mode of onset was systemic illness in six patients, polyarticular disease in six and pauciarticular disease in four.

Fourteen of the patients were classified as having juvenile rheumatoid arthritis (JRA) as they fulfilled the criteria laid down by Brewer and his colleagues in 1973 (see Table I) and showed polyarthritis of two or more joints or monoarthritis of more than three months duration. The joints were either swollen or showed two of the three features of heat, pain and tenderness, or stiffness. Alternatively if the polyarthritis had been present for less than three months the patients also showed one of the following manifestations: a rash, a raised rheumatoid factor, iridocyclitis, involvement of cervical vertebrae, pericarditis, tenosynovitis, intermittent pain or morning stiffness. Twelve of the JRA patients had polyarthritis, one had few joints involved and one had monoarthritis. Two were seropositive and positive to antinuclear antibody (ANA), one ANA-positive and HLA-B27 positive, and one seropositive only. One of the 16 patients developed a juvenile psoriatic polyarthropathy (Lambert et al. 1976); and another, with pauciartthritis developed ulcerative colitis.

The duration of the disease averaged seven years (range 1 to 19 years) and the duration of the hip condition five years (range 1 to 19 years). The mean age at the time of synovectomy was 14 years (range 8 to 29 years). The average follow-up time was 52 months with a range of 6 to 108 months. Three patients had been given one course and 12 patients two or more courses of major drugs such as steroids, chloroquine, gold salts, penicillamine, or cytostatics before the synovectomy. The activity of the disease was described as high, moderate, low or none and was evaluated before the operation and during the follow-up.

Assessment

The scoring system suggested by Merle d'Aubigné and Postel (1954) and modified by Charnley (1972) has been used together with the functional classification of the American Rheumatoid Association (ARA) (Steinbrocker, Traeger and Batterman 1949). Standard antero-posterior and lateral radiographs were taken before operation with the patient supine and were evaluated using a six-grade scale (Larsen, Dale and Eek 1977). Grade 0 represents a normal joint but changes not related to arthritis, for example bone deposition, may be present. In Grade I, one or more of the following changes may be present: periarticular soft-tissue swelling, periarticular osteoporosis and a slight narrowing of the joint space. In Grade II there are definite early changes with small erosions and some narrowing of the joint space. Grade III has moderate destructive changes with large erosions and narrowing of the joint space. Grade IV shows severe destructive changes with major erosions and bone attrition with deformity. In Grade V there are mutilating changes, the original articular surfaces have disappeared and gross bone deformation is present.

At synovectomy the synovial membrane was classified as either being normal or as showing mild, moderate or severe synovitis. The articular cartilage, likewise, was declared to be normal or to be showing mild, moderate or severe erosions (Holgersson et al. 1981).

Operative details

Sixteen of the synovectomies were performed through a lateral (Watson-Jones) approach and the anterior capsule was removed. In five hips tenotomy of the iliopsoas was also performed. By rotating the leg, a greater amount of the synovial tissue can be removed. This technique allows only a limited inspection of the femoral head and almost none of the acetabular cartilage. A partial synovectomy can be performed. In one of the 16 hips (Case 15) the femoral head dislocated spontaneously during the operation after extensive soft-

tissue release. The last two synovectomies were performed through an anterior (Smith-Petersen) approach with dislocation of the hip. A total synovectomy could then be performed taking care of the sub-synovial vascular network of the femoral neck and a complete inspection of the femoral and acetabular cartilage was possible.

Movement is encouraged immediately after the operation. The patient uses an abduction frame while at rest for three weeks. In the three cases where dislocation had occurred weight-bearing was not allowed for six weeks.

RESULTS

The operative findings correlated well with the preoperative radiographs in 14 hips (Table I) but in three there were great discrepancies and the cartilage could not be inspected in one. The greatest difference was in a patient (Case 9) with juvenile psoriatic arthropathy who had severe erosions both on the femoral head and in the acetabulum but in whom the radiograph showed only Grade I changes. The second patient (Case 3) appeared to have advanced radiographic changes (Grade III) but at operation only mild changes were found. The third patient (Case 6) had moderate cartilage changes at operation but only Grade I radiographic changes. None of the hips were radiographically normal before the operation; four were in Grade I, four in Grade II, three in Grade III and seven in Grade IV or V.

The total anaesthetic time was, on average, 117 minutes (range 55 to 210). The peroperative blood loss was on average 325 millilitres (range 50 to 900) and the total blood loss 490 millilitres. The average postoperative patient stay was 26 days (range 14 to 52).

Relief of pain

Eleven patients (13 hips) were satisfied and judged the operation worthwhile (Table II). In one (Case 1) the relief lasted only two years and he was later converted to a total replacement with a good result. The pain was on average 2.4 points before the operation, 5.1 at discharge from hospital and 4.4 points at follow-up. The pain in the contralateral hip was 4.8 points before operation and 4.1 points at follow-up. Four patients (Cases 7, 9, 10, 12) were dissatisfied because the relief of pain was poor or short-lived.

Range of movements

The total range improved slightly at the time of discharge from hospital but was slightly less at follow-up (Table II). One pain-free patient (Case 15) was dissatisfied because of poor hip mobility (Table II): he had mobility Grade I before and after the operation. Twelve patients had a flexion contracture averaging 22 degrees (10 to 55) before the operation and 11 degrees (5 to 30) when they left the hospital. At follow-up 11 patients had an average 23 degrees of flexion contracture (5 to 55). The walking capacity was only slightly improved (Table II).

Function

The patients were on average in ARA class 2.8 before the operation, 2.6 at follow-up.

Activity

Fourteen of the patients had moderate or high activity of their disease before the operation and this persisted in 10 at follow-up. One patient (Case 8) had no disease activity at follow-up (Table I).

Table I. Clinical, radiographic and operative findings in 18 synovectomized hips

Case	Sex	Age at operation	JCA		Hip duration years	Radiograms*			Synovectomy	Operative findings		Disease activity	
			Subgroup at follow-up			1-2 years	At preopera-tively	At operation		Synovia	Cartilage	Before	After
1	F	21	JRA poly-arthritis		10	I	IV	V	tenotomy THR 3 years later	severe synovitis	severe erosions	moderate	high
2	M	12	JRA poly-arthritis		9	II	IV	V	tenotomy	severe	severe	high	moderate
3	M	15	JRA poly-arthritis		7	I	III	V	arthroscopy	moderate	mild	moderate	low
4	F	12	JRA poly-arthritis		5	I	II	II		severe	mild	moderate	low
5	M	15	same patient as no 3		7	I	III	V	arthroscopy	severe	moderate	moderate	low
6	F	9	JRA poly-arthritis		5	0	I	V		severe	moderate	high	moderate
7	M	13	JRA poly-arthritis		3	I	IV	V	THR 3 years later	severe	severe	high	moderate
8	M	14	JRA mono-arthritis		1	0	I	I	arthroscopy tenotomy	severe	mild	low	none
9	F	29	psoriasis poly-arthritis		19	I	I	I	arthroscopy	moderate	severe	low	low

10	F	10	JRA poly-arthritis	3	II	IV	V		moderate	severe	high	moderate
11	F	9	same patient as no 6	6	I	IV	V		severe	severe	high	moderate
12	M	12	JRA pauci-arthritis	1	0	II	V	arthrosco- py surface re- placement 3 years later	severe	moderate	high	moderate
13	F	15	JRA poly-arthritis	8	I	II	IV	tenotomy	severe	could not be in- spected	moderate	moderate
14	F	18	JRA poly-arthritis	4	I	IV	V		severe	severe	moderate	low
15	M	11	JRA poly-arthritis	5	I	II	IV	tenotomy	severe	moderate	high	moderate
16	F	11	pauci arthritis colitis ulcerosa	1	I	I	I		moderate	mild	high	moderate
17	M	10	JRA poly-arthritis	1	II	V	V	tenotomy	severe	severe	high	low
18	F	13	JRA poly-arthritis	5	0	III	III	arthro- scopy tenotomy	severe	moderate	high	moderate

*The classification of Larsen et al (1977) see text.

Table II. Numerical classification of pain, range of movement and walking capacity in 18 synovectomized hips

Case	Follow-up months	Pain		Range of movement		Walking	
		Before operation	After operation	Before operation	After operation	Before operation	Follow- up
1	34	1	4	5	4	2	2
2	108	2	6	4	4	2	1
3	69	2	6	5	5	2	5
4	74	2	5	5	5	2	2
5	67	2	6	5	5	2	5
6	68	2	5	5	6	2	3
7	35	2	5	4	5	2	2
8	68	2	6	4	5	2	6
9	68	3	3	4	4	3	3
10	68	3	5	4	4	2	3
11	67	2	6	5	5	2	3
12	37	2	3	1	2	2	2
13	52	3	6	4	4	3	4
14	44	2	6	4	4	2	5
15	36	5	5	1	1	3	1
16	28	2	5	2	4	2	3
17	6	3	5	1	3	2	4
18	6	3	5	5	5	2	3
Average	52	2,4	5,1	3,8	4,2	2,2	3,1

*The classification of Merle d'Aubigné and Postel (1954) as modified by Charnley, see text.

Radiographic appearance

At follow-up five hips (Cases 4, 8, 9, 16, 18) were in Grade I, II or III and 13 in Grades IV or V (Table I). Those who progressed during the last two years before the synovectomy progressed further with three exceptions (Cases 4, 8, 18).

Three of the synovectomized hips were later converted to total replacements (Cases 1, 7) or surface replacement (Case 12) and in two adductor tenotomies (Cases 1, 14) were performed. The unoperated contralateral hips were all within Grade 0 or I before the operation: seven of these hips progressed radiographically, three to Grade IV or V at follow-up and were later given either a total hip replacement or a surface replacement. At follow-up, 71 operations, including the synovectomies had been performed on these 16 patients with an average of 4.4 operations (1 to 14) on each patient.

There was one superficial infection which healed with antibiotics. Six months later this patient developed a small fistula but after a suture granuloma had been removed the wound healed with no further complications.

Illustrative case report

A 10-year old boy (Case 17), with a three-year history of a systemic onset seronegative JRA which became polyarticular, had had left-sided hip disability for one year. He developed severe adduction and flexion contracture with a total range of movement from 50 to 70 degrees (Grade 1). He had moderate pain (Grade 3) and walked with two crutches. Radiographically he progressed during nine months from Grade II (Fig. 1) to Grade V and the hip subluxated with severe irregular deformity both in the acetabulum and especially laterally in the femoral head (Fig. 2). The patient also developed a flexion contracture of the left knee and a scoliosis. He was operated on via a Smith-Petersen approach and an extensive soft-tissue release was performed. The hip was dislocated and total synovectomy performed.

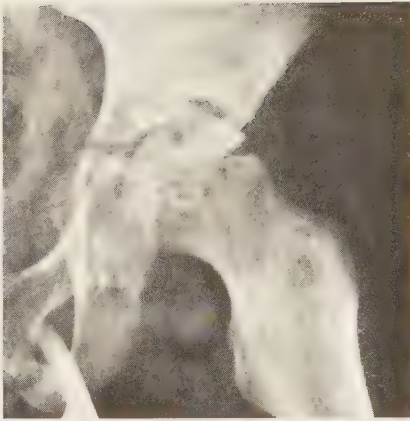


Fig. 1.



Fig. 2.

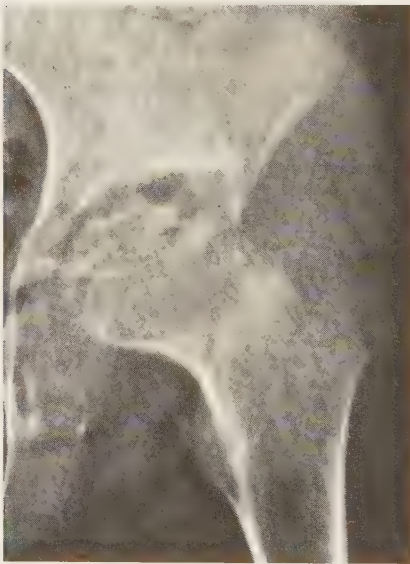


Fig. 3.

Figure 1. Radiograph three months after presentation showing narrowing of the joint space, cysts and erosions (Grade II) but with the hip well contained.

Figure 2. Severe irregular deformity and lateral subluxation of the femoral head 9 months later.

Figure 3. The hip well contained six weeks after operation.

The patient had severe damage to bone and cartilage both in the acetabulum and the femoral head and a severe synovitis. Postoperatively he was placed in a hip spica in abduction but the front part was removed to allow early controlled movement of the hip. The radiographs showed good containment of the femoral head (Fig. 3). Weight-bearing was allowed after three months. The pain was relieved (Grade 6) and the total hip mobility after six months was 65 degrees (Grade 3) with 15 degrees of flexion contracture.

DISCUSSION

The prognosis in JCA is influenced by the mode of onset, subgroups and duration of activity. About a quarter of the patients are left with severe disability (Laaksonen 1966; Hanson et al. 1977). Patients with a duration of activity of less than three years have a more favourable prognosis (Laaksonen 1966). The hip is often involved in JCA and is usually the main drawback to locomotion (Isdale 1970; Arden and Ansell 1978). Previous reports on synovectomy in JCA mention that if it is performed early the results are probably better; most of our cases are indeed late synovectomies where the long-term results are judged to be less favourable. Synovectomy of the hip in children is considered to be a major operation. There is probably a tendency, especially among rheumatologists, to wait and see if spontaneous remission will occur.

Destructive changes of the hips in JCA are late radiographic findings but 75 per cent of hips have narrowing of the joint space after five years of involvement (Rombouts and Rombouts-Lindemans 1971). Irregular extensive damage to the cartilage may be present in spite of an almost normal radiograph (Pahle, Kåss and Munthe 1978). The cartilage was found to be damaged in all our patients. Those with progressive worsening as shown on the radiographs before the operation continued to worsen, with three exceptions (Cases 4, 8, 18) (Table I). Subluxation of the hip due to synovitis and effusion is said to be a common feature in patients with JRA (Rombouts and Rombouts-Lindemans 1971) but occurred in only two of our patients (Cases 1, 17).

At follow-up 11 of 15 patients were satisfied with the relief of pain. Mobility was slightly reduced and walking capacity only slightly increased at follow-up (Table II). In only three hips had replacement been performed.

Synovitis of the hip increases the pressure in the joint and may by itself cause vascular disturbances in the femoral head (Soto-Hall, Johnson and Johnson 1964). Adduction contracture with lateral subluxation and a resulting severe lateral pressure deformity in the femoral head can sometimes be seen (Figs 1 to 3). Arthroscopy of the hip in JCA is a minor operation (Holgersson et al. 1981). If the hip disability cannot be controlled by anti-inflammatory drugs or by physiotherapy, an arthroscopy should be done before radiological changes appear and, if necessary, a synovectomy be carried out. It is reasonable to believe that synovectomy has better results if it is done as early and as radically as possible. The only report on synovectomy in JCA where the hip is dislocated (Albright et al. 1975) makes no mention of any vascular complications and the femoral head is now routinely dislocated in surface replacement for JCA (Mogensen, Svantesson and Lidgren 1981).

Synovectomy can offer permanent relief of pain in the affected joint but often should only be considered as a time-gaining procedure; the relief of pain may delay the need for prosthetic replacement for several years.

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SOFT TISSUE RELEASE OF THE HIP IN JUVENILE CHRONIC ARTHRITIS

by

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ABSTRACT

Adductor and/or subspinal tenotomies were performed on 17 patients (25 hips) with long-standing juvenile chronic arthritis and hip disability. The flexion contracture decreased after surgery from 28 to 18 degrees but had increased to the preoperative level at an average follow-up time of 48 months. The adductor contractures followed the same pattern. All but three of the patients were dissatisfied with the relatively small gain and the short-lasting effect of the operation. Knee contractures and insufficient release are probably some of the reasons for the poor results. A more extensive release is recommended and in the case of hip pain combined with synovectomy.

INTRODUCTION

Soft tissue release to decrease joint contractures and increase the range of movement is one of the basic principles in orthopaedic surgery. Apart from the promising result reported by Jakubowski and Ruszczynska (1967, 1978) in patients with juvenile chronic arthritis (JCA), there is only one more study available in which several joints are discussed (3). The aim of this study is to present our results from soft tissue release of the hip in JCA during a 10-year period.

PATIENTS AND METHODS

Soft tissue releasing operations for hip contractures were performed in 26 hips (18 patients) during a 10-year period from January 1970 to December 1979 at the Departments of Orthopaedic Surgery and Rheumatology, University Hospital, Lund. One patient died of unrelated causes leaving 25 hips (17 patients) for evaluation. The

right side was operated on 13 times and the left side 12 times. There were 12 female and five male patients. The indications for surgery were severe hip contractures in spite of intensive physiotherapy and adequate anti-inflammatory drug treatment.

Adductor tenotomies (A) (all clinically contracted adductor muscles) were performed in 10 hips, subspinal tenotomies (S) (sartorius, tensor fasciae latae, rectus femoris) in nine hips, and adductor tenotomi combined with subspinal tenotomies (AS) in six hips. All of the patients received intensive postoperative physiotherapy. The average age at operation was 14 years (range 8-30 years). All the patients had JCA (10). None of the patients developed ankylosing spondylitis or psoriasis arthropathy. The mode of disease onset was oligoarthritis in nine patients, polyarthritis in two and systemic illness in six patients. At follow-up three patients had oligoarthritis and 14 patients had polyarthritis. The disease duration was on average 8.3 years (range 1-28 years) and the duration of hip symptoms was on average 6.6 years (range 1-26 years). The follow-up time was at least two years for the not reoperated hips or until some new hip procedure was performed. The average follow-up time was 48 months (range 2-111).

The hip pain and the range of movement were evaluated by the scoring system of Merle d'Aubigné and Postel 1954 as modified by Charnley 1972.

Pain

1. Severe and spontaneous.
2. Severe on attempting to walk. Prevents all activity.
3. Tolerable, permitting limited activity.
4. Only after some activity. Disappears quickly with rest.
5. Slight or intermittent. Pain on starting to walk but getting less with normal activity.
6. No pain.

Movement

- | | |
|-------------------|--------------------|
| 1. 0- 30 degrees | 4. 101-160 degrees |
| 2. 31- 60 degrees | 5. 161-210 degrees |
| 3. 61-100 degrees | 6. 211-260 degrees |

The preoperative radiograms were classified by the six-grade scale of Larsen et al 1977 where stadium 0 reveals the normal status of the hip joint while in stadium 5 there are mutilating changes. In one patient (No. 17) the preoperative radiograms were not available for evaluation.

The erythrocyte sedimentation rate (ESR) and the overall joint activity were used to estimate the average disease activity pre- and postoperatively for the following four-grade scale: none, low (ESR < 20), moderate (ESR 20-50) and high disease activity (ESR > 50).

RESULTS

The flexion contractures in the whole material were decreased by surgery from average 28 to 18 degrees after one month and were almost unchanged at one year but had increased to the preoperative level at an average follow-up time of 48 months (range 2-111 months) (Table I). The maximal range of abduction and the total range of movement followed the same pattern (Table I, II). The patients did not have severe pain preoperatively (4.4 points) and they were only slightly relieved from pain by surgery (4.7 points) (Table II). The preoperative radiograms revealed moderate changes or on average 2.9 (range 1-5).

The disease activity did not apparently affect the final results (Table II). Nine patients were treated during the preoperative period either with steroids (4 patients) or steroids in combination with penicillamin (1 patient), gold (2 patients) or cytostatics

Table 1. Tenotomies in flexion and adduction contractures in 25 hips

Operation* performed	Preoperative degrees		Postoperative degrees					
			1 month		12 months		Follow-up average 48 months	
	ED**	MA***	ED	MA	ED	MA	ED	MA
A (10 hips)	27	2	20	12	23	12	40	1
S (9 hips)	28	22	13	22	19	21	22	18
AS (6 hips)	33	2	23	11	28	9	28	6
Average	28	9	18	15	22	15	30	8

* See text. ** Extension deficit. *** Maximal abduction.

(2 patients). Ten patients were treated after surgery either with steroids (7 patients) or in combination with gold (2 patients) or cytostatics (1 patient).

At follow-up 13 of the hips had been reoperated. Total hip replacement had been performed in seven hips (No. 1, 2, 5, 7, 8, 12, 13), surface replacement in one (No. 25), synovectomy in one (No. 22) and femoral osteotomies in four (No. 9, 10, 18, 19). Three patients (four hips) considered the releasing operation worth-while but all the others were negative due to insignificant gain and the short-lasting effect.

DISCUSSION

Hip involvement is common in patients with JCA and is often the major cause of limited locomotion (1, 4). Besides the medical treatment it is of great importance to inform the patient and the parents about the necessity of daily contracture prophylaxis and the patient should be followed at regular intervals to detect eventual increasing

joint contractures. The release operations in this study were generally performed after long-standing contractures and the patients had had their hip symptoms for an average of about seven years (Table II). The patients had moderate changes of the radiograms (7) at the time of surgery and were relatively painfree both before and after the tenotomies (Table II). More than half of the patients had had a major anti-inflammatory drug treatment before and after the release operation and the disease activity did not apparently affect the final results. The results were generally disappointing and all but three of the patients considered the surgery not worthwhile due to the insignificant gain and short-lasting effect (Table I). Knee contractures often lead to hip contractures and vice versa. This is maybe one of the reasons for the poor results in this study but at follow-up 12 capsulotomies of the knees had also been performed.

In the painful hip with synovitis and moderate radiographic changes early synovectomy could be performed with good lasting pain results in three fourths of the patients (9) and in the case of hip contracture a more extensive release including iliopsoastenotomy could eventually give better results (6). In the painfree hip with contracture and inactive synovia, a subspinal releasing operation combined with anterior capsule resection and iliopsoastenotomy should be performed (6). Intensive postoperative physiotherapy including hydrotherapy should be available and the patient must be well-motivated for the surgery and postoperative training.

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Table II. Clinical and radiographic findings in 25 tenotomized hips (17 patients)

Number of hips	Age years	Follow-up months	Mode of disease	Duration of hip symptoms years	Operation* performed	Average** disease activity		Radiographic classification***	Pain****		Range of movement****		
						preoperatively	postoperatively		preoperative score	postoperative score	1 month	12 months	follow-up
1	13	68	oligo-arthritis	11	AS	M	M	2	4	4	2	2	1
2	13	71	oligo-arthritis	11	AS	M	M	2	4	4	1	2	2
3	12	82	systemic	9	A	H	H	4	5	5	3	4	1
4	12	82	systemic	9	A	H	H	5	5	5	3	4	1
5	20	13	systemic	6	A	M	M	4	3	3	2	3	1
6	15	111	poly-arthritis	8	A	L	L	4	4	4	2	3	1
7	19	15	oligo-arthritis	5	A	M	L	4	2	2	3	2	2
8	19	9	oligo-arthritis	5	A	M	L	4	2	2	3	3	1
9	8	55	poly-arthritis	1	S	H	H	1	6	6	5	5	5
10	8	54	poly-arthritis	1	S	H	H	1	6	6	5	5	4
11	12	98	oligo-arthritis	2	AS	M	H	4	4	5	4	4	3
12	30	12	systemic	26	AS	L	L	4	5	5	1	3	3

13	30	2	systemic	26	AS	L	L	4	5	5	2	3	3
14	12	42	oligo- arthritis	1	S	L	L	1	5	6	2	4	5
15	13	41	systemic	8	S	M	M	5	5	6	4	4	4
16	14	26	systemic	9	S	M	M	5	6	6	4	4	4
17	12	81	oligo- arthritis	5	S	H	H		3	4	6	6	5
18	8	71	systemic	3	A	H	M	1	6	6	4	4	4
19	8	71	systemic	3	A	H	M	1	6	6	4	4	4
20	14	50	oligo- arthritis	2	A	N	N	5	4	4	1	1	1
21	14	37	systemic	3	AS	M	L	3	3	5	1	3	3
22	10	5	oligo- arthritis	4	S	H	M	2	5	5	2	2	1
23	10	47	oligo- arthritis	4	S	H	M	1	5	5	5	5	6
24	13	50	oligo- arthritis	2	S	N	N	2	3	5	1	1	1
25	15	4	oligo- arthritis	2	A	L	L	1	3	3	1	2	1
Average		14	48	6,6				2,9	4,4	4,7	2,8	3,3	3,4
													2,7

*See text. **See text. ***The classification of Larsen et al, see text. ****The classification of Merle d'Aubigné and Postel as modified by Charnley, see text.

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SURFACE REPLACEMENT OF THE HIP IN JUVENILE CHRONIC ARTHRITIS

by

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ABSTRACT. Seventeen resurfacing arthroplasties undertaken in 13 patients with severe hip arthritis are described. The youngest patient was 14 years and the mean age 23 years. The average follow-up time is 2 years. In one patient, pain-free for 7 months, the femoral cup slipped and revision into total hip replacement was easily performed. The remaining patients are pain-free, have increased motion, a better walking capacity and can enjoy sex life. The tremendous improvement in quality of life for these young patients justifies operation even if all may have to be converted into total hip replacement within a couple of years, although there is nothing to indicate that in this early follow-up.

Total hip replacement (THR) is the operative method of choice for severe hip disability, especially in the elderly. Young patients, however, can be expected to outlive their prosthesis. Revision arthroplasty is technically demanding and the long-term results uncertain.

Surface replacement has been developed during the last decade, based on the original Smith–Petersen cup. The femoral head and neck is retained and surfaced with a metal cup and the acetabulum is surfaced with a high density polyethylene cup, using methylmethacrylate cement in both. The anatomical, engineering, mechanical, and clinical considerations in surface replacements were summarized in 1978 in *Clinical Orthopaedics* (1, 3, 7, 8, 9, 10, 13, 16, 17, 18, 20).

Rheumatoid disease has been considered only as a relative indication, especially because of the problem of anchoring the prosthesis in atrophic bone (20). This also applies to the THR, however.

The aim of the following report is to describe technical errors and short-term results with resurfacing arthroplasty in young patients suffering from severe chronic arthritis.

PATIENTS AND METHODS

Thirteen patients (17 hips) were operated on with Wagner's surface replacement (19) during the period April 1978–October 1979 at the Departments of Orthopaedic Surgery and Rheumatology, University Hospital, Lund. The average follow-up time is 22 months (range 7–30 months). Eight patients had juvenile chronic arthritis (21), 4 rheumatoid arthritis (14) and one seronegative HLAB27-positive oligoarthritis. The duration of the disease averaged 9 years (range 3–21) and the hip duration 6 years (range 1–18).

All the patients were operated on by the same surgeon (L. L.) and evaluated by another surgeon (B. M.). The scoring system suggested by Merle d'Aubigné & Postel (2) and modified by Charnley (4) adding the activity of daily living (ADL) has been used.

The mean age at the time of operation was 23 years (range 14–43). Three patients were younger than 16 years. The preoperative hospitalization time was on average 7.0 days (1–50 days) and postoperative hospital stay, 31 days (15–70 days).

Standard frontal and lateral X-ray projections were taken with the patient supine.

ANAESTHETIC AND SURGICAL REMARKS

Young patients with long-standing juvenile chronic arthritis are often an anaesthetic problem due to underdeveloped chins, with difficulties in opening the mouth and stiffness or instability of the cervical spine (5). The preoperative anaesthetic time was on the average 70 min (range 45–110 min).

All the operations were carried out by an anterolateral approach (20). In eight of the hips the total motion was less than 30 degrees, with flexion deformities up to a maximum of 60 degrees. Valgus deformity and increased anteversion maximum 70 degrees, together with the flexion contractures, necessitated increased release with tenotomy not only on the ventral side but also on the dorsal side and, in most cases, also of the iliopsoas.

In four hips the inner femoral shaft diameter was less than 10 mm and a custom-made total hip replacement

Table 1. Pain

	Before operation		At follow-up	
	Points	Number of hips	Points	Number of hips
Severe spontaneous	1		1	
Severe on attempting to walk.				
Prevents all activity	2	7	2	1
Pain tolerable permitting limited activity	3	10	3	
Pain only after some activity, disappears quickly with rest	4		4	
Slight or intermittent pain on starting to walk, but lessening with normal activity	5		5	1
No pain	6		6	15
Mean value	2.5		5.7	

would have been necessary if surface replacement had not been done.

The femoral cup was intentionally placed in 5–15 degrees of valgus (5 hips). In one hip the cup was in 10 degrees varus and in 11 hips in neutral position. Two of the patients had femoral heads that were too small for a perfect fit with the smallest femoral cup (42 mm) available at that time. Care was taken to leave at least 4 mm of the acetabular bone stock lateral for a possible total hip replacement later.

Both laminar air flow and conventional operating theatres were used for the operations. All patients received prophylactic antibiotics with Cloxacillin 1 g four times daily for one week (6). In the first 10, gentamicin cement was also used (12).

The operative time was, on average, 112 min (range 85–150). The perioperative bleeding was on an average 950 ml (range 400–3 000) and during the total hospitalization, 1 335 ml (835–3 470 ml).

RESULTS

All but one patient (see Complications) were satisfied with the pain relief. Pain was diminished by 3.2 points on an average (Table I). Ten of the patients used walking aids before and 3 after the operation. Twelve patients had a minor or major problem with some other joint of the lower extremity at follow-up. Walking was improved by 2.5 points on an average (Table II). The leg lengthening was 0.6 cm on an average. Eleven of the 17 hips had a total range of motion less than 60 degrees before the operation and all but one had more than 100 degrees afterwards (Table III). Average range of motion was improved by 2.8 points. All but one had the same range of motion or greater at the follow-up as when they left the hospital.

Nine of the patients needed daily help at home before the operation and after the operation 2 needed daily help, 3 twice a week and 4 none.

Eight patients were sexually active before the operation. All had problems due to pain and stiffness. Two of the women could not have intercourse because of hip contractures. Seven had no problems after the operation due to the hip. The eighth patient, a woman, had no pain but was dissatisfied because of poor hip mobility (class 3 on the operated and 3 on the other hip).

COMPLICATIONS

There have been no infections or luxations.

One patient, initially pain-free, had a mechanical loosening of the femoral cup after 7 months. The femoral cup was in 10 degrees of varus from the beginning and too big to make a perfect fit. The patient was reoperated with THR with good results.

In another patient, who had cystic deformation of the femoral head and only 25 degrees of the total hip motion, the femoral cup had shifted from neutral into 10 degrees of varus at follow-up 17 months later. The patient did not notice any change in the hip function and had a hip motion of 210 degrees.

One patient, operated bilaterally, had a normal X-ray after 6 months but at follow-up one year later a radiolucent zone of 4 mm had developed around both the acetabular cups, mainly inferiorly. The patient is pain-free.

One patient, who had a fixed 45 degree flexion contracture for 8 years developed a total paresis of the femoral nerve immediately after the operation.

Table II. *Ability to walk*

	Before operation		At follow-up	
	Points	Number of patients	Points	Number of patients
Bedridden or few yards.				
Two sticks or crutches	1		1	
Time and distance very limited with or without sticks	2	9	2	
Limited with one stick (less than 1 h).				
Difficult without stick.				
Able to stand long periods	3	4	3	2
Long distances with one stick.				
Limited without a stick	4		4	2
No stick but a limp	5		5	4
Normal	6		6	4
Mean value	2.3		4.8	

To dislocate the femoral head it was necessary during the operation to do an extensive release. EMG showed a total paresis but sensibility continuity. One year later the patient had a quadriceps muscle strength on the dynamometer of 27 kg and 40 kg on the healthy side. EMG showed a total recovery.

In the only patient with HLAB27-positive oligoarthritis the hip mobility decreased from class four to three due to ossifications. The patient had slight pain (class 5). Before the operation, this patient had a fixed 40-degree flexion deformity; at 6 months there was para-articular calcification, which had increased to grade three (15) 8 months later.

DISCUSSION

Resurfacing arthroplasty has been developed in the 'seventies by several groups (1, 3, 8, 9, 10, 13, 17, 18, 20) as an alternative to THR. Most of the reports after 3–5 years are promising (1, 8, 20) but no

long-term follow-up is yet available. Most of our young patients were very satisfied with the improvement in the quality of their life attributable to pain relief (12/13), greater walking capacity (12/13), better hip motion (13/13), less dependence (7/9), and more enjoyable sex life (7/8).

Young arthritic hips often have a femoral head that is small and atrophic and a smaller, 38 mm cup is now available for these patients. In 2 of our patients the femoral head was too small to make a perfect fit for the smallest available 42 mm cup. One of these cups loosened but was also in a 10 degree varus position from the outset. Loosening of the femoral component will probably occur less frequently if the cup is placed in valgus in line with the loading mechanical axis (7, 11). Surface replacement gives an average lengthening of the leg of 0.6 cm. Operative correction of a longstanding fixed flexion contracture of more than 45 degrees will also lengthen the femoral nerve by 1–2 cm. Stretching the nerve by the retractors during operation and postoperative swelling are other factors that may have contributed to the reversible femoral paresis in one patient. In a few larger reports (1, 20) it seems that the frequency of deep infections and dislocations is less than with total hip replacement.

Resurfacing arthroplasty can be recommended also in young arthritic patients as an in-between procedure to gain time, especially regarding quality of life.

Later exchange of a component or total hip replacement can be performed without difficulty as the thin flexible polyethylene cup can easily be tor-

Table III. *Range of movement*

Degrees	Before operation		At follow-up	
	Points	Number of hips	Points	Number of hips
0–30	1	8	1	
30–60	2	3	2	
60–100	3	3	3	1
100–160	4	3	4	4
160–210	5		5	10
210–	6		6	2
Mean value	2		4.8	

sioned out and replaced. The femoral prosthesis can be inserted in the usual manner.

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SURFACE REPLACEMENT OF THE HIP IN CHRONIC ARTHRITIS

A clinical, radiographic and roentgen stereophotogrammetric
evaluation

by

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ABSTRACT

Surface replacement of the hip was performed in nine patients (11 hips) with chronic arthritis which were evaluated twice clinically, radiographically as well as by roentgen stereophotogrammetry on average at 15 and 23 months. The early clinical results were promising. One or both of the components were loose in five hips and the acetabular socket had migrated in one as revealed by the radiograms. Roentgen stereophotogrammetry revealed loosening in one hip and migration of one or both the components in altogether eight hips. The radiograms gave the information needed in the daily routine but roentgen stereophotogrammetry gave better information about early migration. At the third clinical follow-up on average 35 months postoperatively, two hips had been reoperated and two developed hip pain.

INTRODUCTION

Surface replacement of the hip has been on the increase during the last decade as an alternative to total hip replacement (THR) especially in younger patients with hip disability (Freeman 1978). Chronic atrophic arthritis has been considered as a relative indication due to poor quality of the bone tissue (Wagner 1978). THR in patients with juvenile chronic arthritis (JCA) is also encountered with the same problem and the long-term results indicate that several revisions may be necessary (Mogensen et al. 1982).

Well-aware of the risks but with the hope of gaining time, the present authors started performing surface replacement of the hip 1978 in patients with JCA. The early clinical results have been presented earlier (Lidgren et al. 1981, Mogensen et al. 1981). It is therefore of great interest to evaluate how the surface replacement prosthesis components behave in patients with poor bone quality as in JCA.

Conventional radiograms are convenient to use but it may be difficult to reveal early changes of the position of the prosthetic components. Roentgen stereophotogrammetry offers a very high accuracy to determine the three-dimensional position of implants in the bone (Selvik 1974). The method has been used in Lund for determination of migration and wear of THR (Baldursson et al. 1979, Baldursson et al. 1980). This method can also be used in surface replacement of the hip. This study is a comparison of clinical, radiographic and roentgen stereophotogrammetric findings in surface replacement of the hip in young patients with chronic arthritis.

PATIENTS AND METHODS

Surface replacement of the hip was performed in 13 patients (17 hips) with chronic arthritis from April 1978 to October 1979. Nine of the patients (11 hips) have been further evaluated by roentgen stereophotogrammetry and the results compared with the radiographic changes and the clinical results. The average age at the time of surface replacement was 23 years (range 14-43 years). There were six female and three male patients. Six of the patients had JCA (Wood 1978) and three had rheumatoid arthritis. Disease duration was from two to 13 years and the duration of hip symptoms from two to 12 years.

Clinical and radiographic evaluation

The patients were evaluated twice clinically, radiographically and by roentgen stereophotogrammetry. The radiograms were always obtained within three months from the clinical and roentgen stereophotogrammetric examination. The scoring system used by Merle d'Aubigné and Postel (1954) as modified by Charnley (1972) was used for the clinical evaluation. The first evaluation was on average at 15 months (range 9-24 months) and the second evaluation on an average of 23 months (range 12-33 months). A third clinical evaluation

was performed for the non-reoperated patients on an average 35 months (range 27-44 months) after the surface replacement. Conventional A-P and lateral radiograms were used for the radiographic evaluation. The acetabular socket was considered loose if there was a radiolucent zone of more than 2 mm locally or all around the socket. The femoral cup was considered loose if there was a change in the original position.

Roentgen stereophotogrammetric investigation

Tantalum balls, 0.8 mm in diameter, were inserted in local anaesthesia using a special instrument (Aronson et al. 1974) and guided by fluoroscopy into the patients three months to two years after the surface replacement. Four balls were inserted percutaneously through four punctions about 1 cm apart into the crista iliaca and four balls through one puncture into the trochanter major. The roentgen stereophotogrammetric examination was performed with the following technique: Simultaneous exposures of the hip were made with two roentgen tubes 65 cm apart with the operated leg hanging freely (Figure 1) and another examination with the patient standing on the operated leg. At the first investigation one examination was also performed with the leg in abduction.

Before the patient investigation the stereo roentgen set-up was calibrated using a glass-plexiglass test object with known three-dimensional positions of tantalum markers. A reference plate with tantalum markers in front of the film was exposed at this calibration and in the patient investigations the relation between the roentgen foci and these reference markers, exposed on the patient films, was unchanged.

The first roentgen stereophotogrammetric examination was performed at times varying from the same day and up to 65 days after the insertion of the tantalum balls (in ten cases within one month). The second investigation was performed one to 13 months after the first

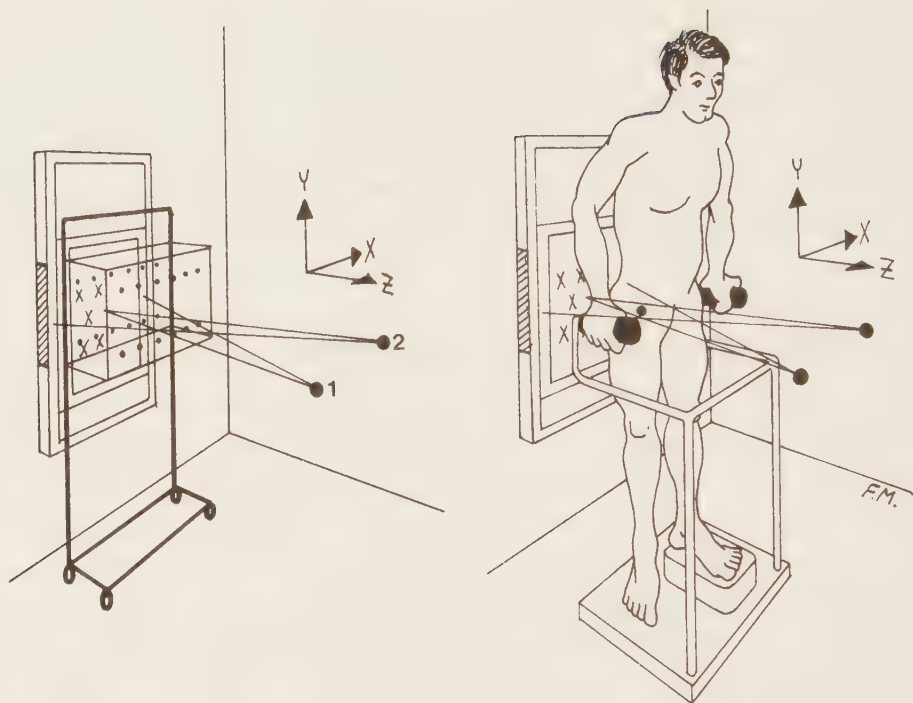


Fig. 1. Unloaded stereo roentgen examination of the right hip. The stereo roentgen set-up is first calibrated using a test object with tantalum markers in two planes. In front of the film a reference plate with tantalum markers (shown for focus 2) is fixed and these markers are used to relate film co-ordinates in patient investigations to the laboratory co-ordinate system.

one. The films were evaluated by the method described by Baldursson et al. (1979) with the modification that the metal ring in the acetabular socket was also evaluated as there were no tantalum markers in the socket. With this method the position of the center of the sphere of which the femoral cup represents a part and the center of the acetabular indicator ring were calculated. Instability (displacement from unloaded to loaded examination the same day) and migration of both the acetabular socket and the femoral cup were determined in relation to the tantalum indicators in the crista and the trochanter, respectively, as well as the hip joint laxity, which was taken as the vertical movement between the femoral cup and ring center.

RESULTS

Clinical results

Initially the patient had a very satisfactory pain relief after the surface replacement. The hip pain was on average 2.6 points before the arthroplasty and at the first (15 months) and at the second follow-up (23 months) 5.6 and 5.3 points, respectively. At the third clinical follow-up two hips (No 3, 7) had been reoperated and two others had developed hip pain (No 6, 11) (Table I).

One of the reoperated hip (No 7) was painfree for seven months but then developed pain. The radiograms revealed three months later that the femoral cup which was in 10 degrees of varus from the beginning had slipped further into varus and later became grossly displaced. THR was performed after 13 months with good results so far. The other reoperated patient (No 3) had JCA and bilateral surface replacement (No 3, 4) was performed in spite of acetabular protrusion on the right side. During the operation on the right side (No 3) the patient had a fracture of the central part of the acetabular floor which eventually healed. The patient was painfree in the beginning but developed severe hip pain 25 months later and the acetabular cup was replaced because of loosening.

The range of hip movement increased from on average 2.3 points before operation to 4.7 points at the last follow-up. All but one were in class 4 or better after the arthroplasty but six hips were in class 1 (four hips) or class 2 (two hips) before the operation (Table I). There was a small increase in the walking capacity from 2.2 points before the operation to 3.9 points at the last follow-up, mainly because of involvement of other joints in the lower extremities. This improvement was, however, considered to be most important by the patients.

TABLE I. Numerical Classification* of Pain, Range of Movement and Walking Capacity regarding 11 Surface Replacements in Nine Patients

Number of hip	Follow-up Months			Pain		Range of movement				Walking	
				Before operation	Follow-up	Before		Follow-up		Before operation	Follow-up
	1	2	3			operation	1	2	3		
1	24	33	44	3	6	6	5	1	6	5	5
2	20	28	40	2	6	6	6	2	5	5	3
3	17	26	**	2	6	2	**	2	5	5	**
4	17	31	37	2	6	6	5	3	5	5	3
5	17	25	36	2	6	6	5	3	5	5	3
6	15	23	34	2	6	6	3	4	5	6	5
7	11	12	**	3	2	2	**	3	4	4	**
8	11	20	31	3	6	6	6	1	4	4	3
9	11	20	31	3	6	6	6	4	5	5	5
10	11	20	31	3	6	6	6	1	4	4	4
11	9	16	27	3	6	6	4	1	5	5	4
Average	15	23	35	2,6	5,6	5,3	5,1	2,3	4,8	4,8	4,7
										2,2	4,3
											4,0
											3,9

* The classification of Merle d'Aubigné and Postel as modified by Charnley, see text. ** Reoperation, see text.

Radiographic results

At the first radiographic follow-up (15 months) there was a radiolucent zone around all 11 acetabular sockets (Table 2). Around seven sockets the zone was 1 mm or less, in one socket 2 mm medially and 1 mm laterally, in two sockets 3 mm medially and 1 mm laterally and in one socket 4 mm medially and 1 mm laterally.

At the second follow-up (23 months) there were complete radiolucent zones around the acetabular sockets. Around six of the sockets the zones were still 1 mm or less, one socket had 2 mm medially and 1 mm laterally. In one socket (No 3) the zone had progressed from 4 mm medially and 1 mm laterally to 5 mm medially and the socket was replaced because of hip pain 26 months postoperatively. In another hip (No 2) there was progression from 3 to 5 mm medially but the 1 mm lateral zone was unchanged and the socket had rotated into a more vertical position. One socket (No 4) with 1 mm zone all around had also migrated upwards 5 mm and slightly medially as compared with the initial films (Figure 2).

A 15-year old boy with severe JCA, bilaterally operated had a 3 mm zone medially and 1 mm laterally of the right socket (No 10) and 1 mm on the left (No 8) at the first follow-up. At the second follow-up he had a 6 mm zone medially and 1 mm laterally and the socket had rotated into a more vertical position on the right side and on the left side there was a 2 mm zone. Both the femoral cups were in a neutral position from the beginning but had moved into 5 degrees of varus at the first follow-up. At the second follow-up the cups were in 10 degrees of varus, both had migrated a few mm and there was resorption of the femoral neck on both sides. This patient could walk short distances with two crutches before the operation. He had started jogging about 5 kilometers twice a week after the operation but mentioned this too late. He was, however, still painfree and used no walking aids at the third follow-up 31 months later. In one more hip (No 7) the femoral cup tilted into varus and total hip replacement was performed after 13 months.

Table II. Roentgen stereophotogrammetric and radiographic analysis.

Number of hip	Follow-up months	Acetabular socket			Femoral cup		
		Roentgen stereophotogrammetry*		Radiographic changes	Roentgen stereophotogrammetry*		Radiographic changes
		Instability	Migration		Instability	Migration	
1	24	N.S.	N.S.	1 all around	N.S.		
	33	N.S.		1 all around	N.S.	N.S.	None
2	20	N.S.		1 laterally 3 medially	N.S.		
	28	N.S.	N.S.	1 laterally 5 medially	N.S.	-1.1	None
3	17	N.S.		1 laterally 4 medially	N.S.		
	26	N.S.	1.3	1 laterally 5 medially	N.S.	-1.2	None
4	17	N.S.		1 all around	N.S.		
	31	N.S.	1.3	1 all around	N.S.	-1.3	None
5	17	N.S.		1 all around	N.S.		
	25	N.S.	N.S.	1 all around	N.S.	-1.7	None

6	15	N.S.	1.0	1 laterally 2 medially	N.S.	N.S.	None
	23	N.S.		1 laterally 2 medially	N.S.		
7	11	N.S.		1 all around	-0.7		Initially in 10 ⁰ of varus and subsided
	12	N.S.	1.2	1 all around	***	-6.6	
8	11	0.6		1 all around	N.S.		0 ⁰ into 10 ⁰ of varus and subsided
	20	N.S.	2.7	2 all around	N.S.	-2.2	
9	11	**	**	1 all around	N.S.	N.S.	None
	20	**		1 all around	N.S.		
10	11	**		1 laterally 3 medially	N.S.		0 ⁰ into 10 ⁰ of varus and subsided
	20	**	**	1 laterally 6 medially	N.S.	-2.0	
11	9	N.S.	N.S.	1 all around	N.S.	N.S.	None
	16	N.S.		1 all around	N.S.		

*Translations along vertical (Y-axis) in mm. Only values higher than 0.5 mm are considered significant; see text. N.S. = not significant. ** Could not be evaluated; see text. *** Only examination at this occasion; see text.



Fig. 2. Hip No 4. The tantalum balls are relatively well spaced. Migration can be observed as indicated by a gap between the lower part of the cement and the lower part of the acetabulum.

Roentgen stereophotogrammetric analysis

When the films were analysed it became evident that the spreading of the tantalum balls in the crista iliaca and the trochanter major were not satisfactory. The balls in the crista iliaca were often very close to a straight line and the balls in the trochanter major were too collected. An overall accuracy of about 0.1 mm along the X, Y and Z coordinate axes could therefore not be obtained (Olsson 1975, Baldursson et al. 1979). For definition of coordinate axes and positive axis directions see Figure 1. Control analysis

consisting of calculating movements between repeated unloaded investigations and re-evaluations of stereo films, revealed that movements of the components up to 0.5 mm along the vertical (Y-) axis were within the error of the method and only values exceeding 0.5 mm were considered to be representative of true movements. However, in some cases with a better than average placement of implants it was evident that the measurement quality was about five-fold better. It could have been possible to calculate separate precision values for the different configurations of tantalum implants, but this was considered too laborious and the value of 0.5 mm in the loading direction representing the less favourable but most common configuration was used for the whole material. The precision in calculating translations along the transverse and sagittal axes was smaller because of the position of the indicators in the crista iliaca along an axis mainly in the anterior-caudal, often almost vertical direction, and here the variability between the cases was also larger.

Acetabular sockets

Only one acetabular socket (No 8) showed a movement exceeding the error of the method (> 0.5 mm) along the Y-axis at the stability test on the first examination. All the acetabular sockets were stable on the second examination (Table 2). Two hips were not evaluated, one (No 9) because the wire around the cup was missing and in the second (No 10) because one of the tantalum balls in the crista was not stable and the other three formed a straight line. The socket migrated cranially 1.1 mm to 2.7 mm in five hips (Table 2). The migration is the calculated movement between the unloaded examination at the two follow-ups.

An illustration of the measurement quality and three-dimensional displacements when the tantalum balls are spaced in a better than average configuration is given by hip No 4 (Figure 2). The displacement vector of the acetabular ring center in relation to the pelvic implants was (0.0, -0.1, 0.2) mm between two unloaded examinations

at the 17 month follow-up, for the stability test on that occasion it was (0.3, 0.1, 0.1) mm, (0.0, 0.0, 0.1) mm for the loading by abduction, and for the stability test at the 31 month follow-up it was (-0.3, 0.0, 0.2) mm. The migration was (-1.0, 1.3, 0.0) mm. The migration vector corresponds well with the medial radiolucent zone (left side prosthesis, -X translation medially).

Femoral cups

The femoral cups were stable according to our criteria (verical movement ≤ 0.5 mm) in all but one hip. In this hip (No 7) there was at both examinations a caudal displacement of 0.7 mm and 6.6 mm, respectively, but the second value is the migration between the unloaded examination on the first occasion and the only examination (in abduction) on the second. Six of the femoral cups subsided 1.1 mm to 2.2 mm between the follow-ups (Table 2) but none was symptomatic. In one case, hip No 8, there was a greater cranial movement, 1.4 mm of the acetabular socket, at the examination under abduction than under loading by standing, and in one case (No 3) there was a limit value, -0.5 mm of the femoral cup under loading with standing but a movement of -1.0 during abduction.

Laxity

In one hip (No 11) the joint laxity was 0.9 mm at the first examination and in another hip (No 8) it was 0.9 mm at the second evaluation. In a third hip (No 9) with no wire around the cup the joint laxity and eventual instability of the socket measured 0.8 mm and 0.9 mm, respectively, at the two examinations.

DISCUSSION

The era of total hip prosthesis started by Charnley in the early sixties and the 10 to 15 years results are promising but not without problems (Charnley 1979, Salvati et al. 1981). Three fourths of the

metal-on-plastic prosthesis will probably survive for 20 years but the annual reoperation rate tends to increase with time due to mechanical loosening (Dobbs 1980). In 50 THR in JCA with an average follow-up time of 77 months there were six reoperations, four due to mechanical loosening and two due to infection. Ten hips were radiographically loose and two of these are waiting for reoperation (Mogensen et al. 1982).

Surface replacement of the hip has been developed during the seventies as an alternative to THR for younger patients with hip disability. The aim has been to preserve the femoral head. Revision to a total hip arthroplasty could therefore be performed later if needed.

Increased frequency of radiolucent zones and migration of the THR acetabular socket has been reported in patients with rheumatoid arthritis (DeLee & Charnley 1976, Charnley 1979), and severe chronic arthritis has only been considered as a relative indication (Wagner 1978) or even a total contra-indication (Scott & Sledge 1981) for surface replacement due to poor bone quality. However, all types of THR, cemented or uncemented, have the same basic anchorage problems in this patient group.

Surface replacement of the hip is technically more demanding especially in JCA often due to contractures, increased valgus and anteversion which cannot be corrected by this procedure. Because of the small skeletal size an extra small prosthesis had to be developed for our patients (Lidgren et al. 1981, Mogensen et al. 1981). Our early clinical results were promising with 16 out of 17 hips relieved from pain (Mogensen et al. 1981). At the third follow-up two patients had been reoperated and two had developed hip pain. The degree of pain relief was lower than the previous rating but still satisfactory and appreciated by the patients (Table I).

Concerning the acetabular sockets only one (No 8) out of 11 showed

signs of instability (vertical movement >0.5 mm). However, this instability was only found at the first examination. Furthermore the acetabular socket in hip No 3 showed no instability either at the first nor at the second examination but the migration between the examinations was 1.3 mm. The radiograms revealed on both occasions a radiolucent zone measuring about 4 and 5 mm medially. The acetabular socket was found loose at reoperation. The reason for the roentgen stereophotogrammetric stability test not giving this information is probably that the pain induced muscle contracture was stronger than the difference in the compressive force between "unloading" and weight-bearing of the hip. Five acetabular sockets migrated 1.0 to 2.7 mm. In three hips there was a radiolucent zone of more than 2 mm and two of these had also rotated into a more vertical position. One acetabular socket had migrated radiographically about 5 mm compared to the initial films.

In one patient (No 7) later reoperated the femoral cup had moved 0.7 mm at the first examination and 6.6 mm between the first and second examination, but the radiograms also revealed changes in the position of the femoral cup at both examinations. All other patients had stable femoral cups. There was subsidence of the femoral cups of 1.1 to 2.2 mm in six hips but the radiograms revealed changes in only two of these hips.

To achieve precise results by roentgen stereophotogrammetry the skeletal indicators must be widely spread in the bone (Olsson 1975, Baldursson et al. 1980). Probst (1980) has developed a qualified method for roentgen stereophotogrammetry of prosthetic components and has also met the problem with skeletal indicators too close to a straight line. The roentgen technique used in this study with simultaneous exposures is more convenient than that of Probst (1980) especially if films of hips under load are to be obtained.

Conventional radiograms were satisfactory for the daily routine in this study and gave the information needed. However, for the more precise analysis the roentgen stereophotogrammetric method is superior in the evaluation of early migration. Stereophotogrammetric and radiographic examination revealed changes in more than half of both components and this together with the decreasing pain score and the reoperations is alarming.

In the thin acetabular socket the maximum stressing forces are 1.4 times higher but distributed only over about one half of the area of bone cement interface compared with the thicker socket (Charnley 1979). These increased forces may be too much for the soft bone in some of the JCA patients. It is likely that the fixation of the acetabular socket can be increased by performing multiple small burrholes and using a pressurizer (Eftekhar 1980, Ling 1980), but a disadvantage of the method is that the true subchondral bone can not be preserved. A minimal increase of the thickness of the acetabular socket by using a metal backing could reduce the stress forces and better distribute them over the bone cement interface (Harris 1982).

It is a minimal demand that surface replacement prosthesis survives without clinical problems for at least five years in the JCA patients. The presented patients were the first to be operated with surface replacement prosthesis at our department. With careful selection of the patients and by changing the operation technique and the prosthesis design it should be easier to reach this goal. Patients with JCA and severe protrusio, fixed flexion contracture of more than 45 degrees, severe valgus deformity and/or increased anteversion are in our department today operated with total hip prosthesis.

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TOTAL HIP REPLACEMENT IN JUVENILE CHRONIC ARTHRITIS

by

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ABSTRACT

Fifty total hip replacements in 33 patients with juvenile chronic arthritis were performed during a ten year period with good pain reduction, increased hip motion but only a moderate increase in walking capacity. The average age at operation was 26 years and the average follow-up time 77 months. Six hips (patients) have been re-operated, one for infection, one for suspected infection and four due to mechanical loosening. Loosening was revealed radiographically in ten hips at follow-up. Lack of cement cover and varus position was the main reason for femoral stem loosening. Considering the high loosening rate it is probable that at least one revision arthroplasty will be necessary in the future.

INTRODUCTION

Ten to 15 years of experience with total hip replacement (THR) has been encouraging but the failure rate increases with time mainly because of mechanical loosening^{8, 30}. Most young patients will therefore probably outlive their prosthesis. In patients with juvenile chronic arthritis (JCA) there are also often special problems such as anaesthetic difficulties, severe multiple joint involvement, protrusio acetabuli, soft bone tissue and small skeletal size. A custom-made prosthesis is often necessary. Only a few short-term reports on THR in patients below the age of 30 are available^{1, 5, 9, 12, 19, 31, 32}. The aim of this study is to present our results of 50 THR in patients with JCA with an average follow-up time of 77 months.

PATIENTS AND METHODS

During the past ten years (1970-1979) 50 THR (Fig. 1) in 33 patients with JCA were performed at the Departments of Orthopaedic Surgery

and Rheumatology, University Hospital in Lund, Lund, Sweden. The average age of the patients at operation was 26 years (range 15-51 years). Nineteen were female and 14 male. The THR was performed on the right side in 26 hips and on the left side in 24 hips.

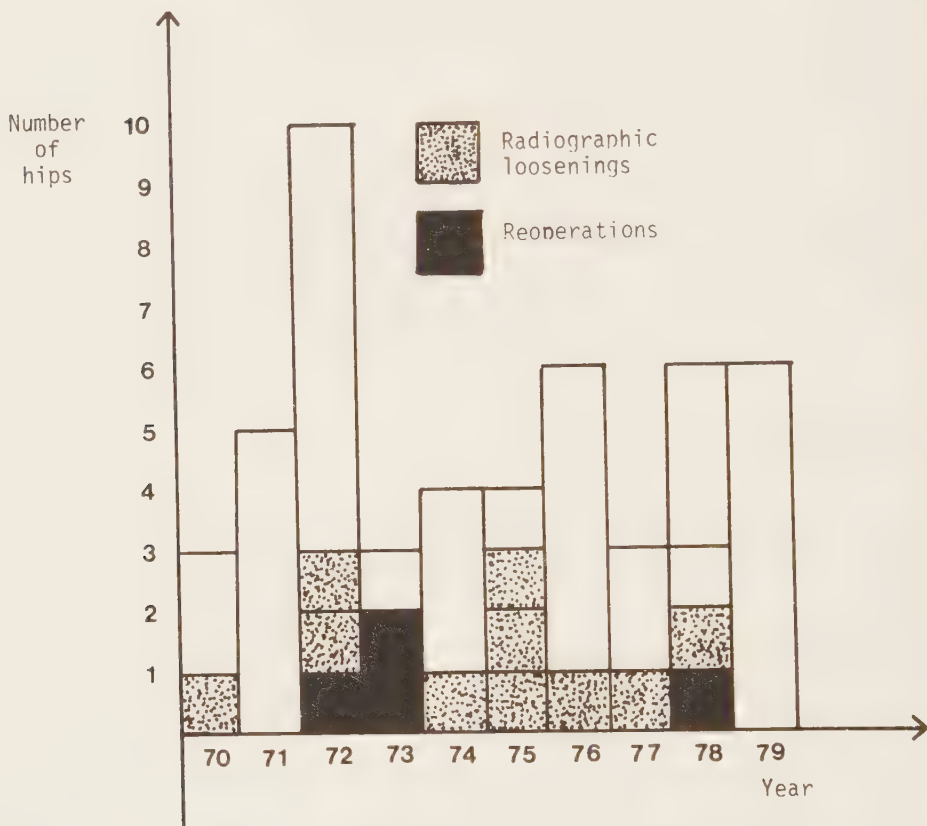


Fig. 1. Fifty THR in JCA. The annual number of operations, radiographic loosening and non-infected reoperations during a ten-year period.

All the patients had juvenile chronic arthritis³⁵. At follow-up 28 (41 hips) of the patients were classified as having juvenile rheumatoid arthritis (JRA) and five patients ankylosing spondylitis (nine hips, Table II, No 5, 7, 8, 9, 11, 12, 19, 24, 43). All the patients had polyarthrititis at follow-up. The duration of the disease

at operation averaged 18 years (range 6-49 years) and the duration of hip symptoms 13 years (range 1-49 years). Pain and/or poor motion was the main indication for THR in 36 hips, and severe contractures and poor motion for another 14 hips. Twenty-eight operations had been previously performed in 24 hips. Cup arthroplasty in 6, synovectomy in 4, osteotomy of the proximal femur in 2, hip arthrodesis in 1, Girdlestone in 1, Chiari osteotomy in 1, acetabular roof plasty in 1, arthroscopy in 1 and soft tissue releasing operations in 11 hips.

The scoring system suggested by Merle d'Aubigné and Postel 1954 as modified by Charnley 1972 has been used for evaluation (Table I). The functional classification of the American Rheumatoid Association (ARA)³³ was also used.

Table I. Numerical Classification of the Clinical State of Affected Hip Joints

Score	Pain	Range of movement degrees	Walking
1.	Severe and spontaneous	0- 30	Few meters or bedridden. Two sticks or crutches.
2.	Severe on attempting to walk. Prevents all activity.	31- 60	Time and distance very limited with or without sticks.
3.	Tolerable, permitting limited activity.	61-100	Limited with one stick (less than one hour). Difficult without a stick. Able to stand long periods.
4.	Only after some activity.	101-160	Long distance with one stick. Limited without a stick.
5.	Slight or intermittent. Pain on starting to walk but getting less with normal activity.	161-210	No stick but a limp.
6.	No pain.	211-260	Normal.

Standard AP and lateral radiograms were obtained with the patients in a supine position preoperatively, postoperatively, within six months later when needed and at follow-up. In three patients, radiograms obtained within 12 months from the last clinical evaluation were used. The preoperative radiograms were evaluated according to

Larsen et al 1977 using a six-grade scale where stadium 0 is normal and stadium 5 reveals mutilating changes.

The radiographic findings were considered to be abnormal if there was a radiolucent zone of more than 2 mm locally or all around the cement, or between the cement and the components. The cement cover around the components and the position of the components were evaluated and correlated to the radiolucent zones and to the clinical findings. Valgus and varus position of the femoral stem was determined by its orientation to the longitudinal axis of the femur as revealed by the AP radiograms.

Surgical and anaesthetic remarks

Thirty-five of the THR were performed under intubation anaesthesia. Intubation was difficult in seven of these cases and a fiberoendoscope had to be used. In seven cases intubation was tried but could not be performed. Inhalation anaesthesia was used in eight cases. Epidural anaesthesia alone was used for two patients and epidural combined with inhalation anaesthesia for five.

The lateral incision was used in 39 hips combined with trochanter osteotomy in one of the hips. The postero-lateral incision was used in 11 hips. For 11 patients with severe bilateral hip and knee contractures, the special lay-up technique of the patient on the operation table was needed using an unsterile assistant according to McKee-Farrar²¹ with a minor modification (Fig. 2). Soft tissue releasing operations were necessary in 19 of the THR to correct flexion and/or adduction deformities. Nine hips were clinically ankylosed. In one patient out of 11 with severe acetabular protrusion a spongy bone transplantation from the femoral head to the acetabular roof was performed. The following prosthesis were used: McKee-Farrar (MKF) 18, Howse Arden (HA) 15 (small prosthesis, designed for JCA), McKee-Arden (MKA) 7, Lubinus (L) 7, Howse (H) 1, Howse mini (HM) 1 and Brunswick (B) 1 (Table II). Four of the small



Fig. 2. The patient on the traction table and an unsterile assistant manipulating the leg.

femoral stems had to be decreased further preoperatively to fit the inner femoral diameter in our patients and twice it was necessary to decrease the already small acetabular cup. Both hips were simultaneously operated on in one patient. In six patients both hips were operated on during the same hospital stay.

In 41 replacements there were adequate antibiotic prophylaxis with cloxacillin 1g x 4 times daily¹¹. The first injection was given at the time of premedication and continued for one week. Four patients were given antibiotics during the procedure and five received no antibiotics at all. An abduction pillow was used 14 nights post-operatively. Exercises were started on the day after the operation and weight-bearing as soon as possible. Hydrotherapy was used in most cases after wound healing.

RESULTS

The preoperative anaesthetic time averaged 65 minutes (range 25-155 minutes) and the average operation time was 155 minutes (range 55-255 minutes). The peroperative bleeding was 1675 ml (range 500-5900 ml) and the total bleeding 2115 ml (range 855-6575 ml). The total hospital stay was on an average 56 days (range 14-297 days). Five patients stayed more than 100 days and often multiple procedures were performed during the same hospital stay.

Early complications

The femoral shaft was perforated once during reaming but this was observed and the prosthesis could be cemented in a good position. One patient with severe acetabular protrusion had a fracture of the acetabular wall during the operation which eventually healed. One patient had a severe anaphylactic reaction due to dextran infusion but he recovered. In two patients (three hips, no 33 and 31, 34, Table II) it was necessary to mobilize the hips postoperatively under general anaesthesia. There were two postoperative dislocations (no 30, 34), one during physiotherapy after three days and one after two months. Both were reduced under general anaesthesia and treated with traction for three weeks without further dislocations. The lateral angle was 60 degrees of both cups and one was also retroverted

Late complications

There was one deep infection in a patient who did not receive any preoperative antibiotics (no 6, Table II). The patient was in the beginning almost painfree (grade 5) but later had increasing pain (grade 4), progressing radiolucent zones and subsidence of the femoral stem. Revision arthroplasty with gentamicin cement was performed after 68 months with good results until the patient fell and sustained a femoral fracture below the femoral stem 34 months after the revision arthroplasty. *Propionibacterium acnes* was cultured in three out of five tissue biopsies at reoperation¹⁸. After four months

of traction without any tendency to bone healing this patient was again reoperated with a 300 mm Lubinus prosthesis with good results at follow-up after 21 months. Five tissue biopsies were negative at the second revision arthroplasty. In another patient (no 39, Table II) deep infection was suspected. He was never painfree after the THR and the radiograms revealed progressing irregular radiolucent zones (>2 mm) between the cement and the femoral shaft^{4, 34}. Erythrocyte sedimentation rate was 91 mm at 13 months when revision arthroplasty with gentamicin cement was performed with good results 31 months later. Five tissue biopsies were negative, possibly due to an unfortunate cloxacillin prophylaxis at the time of premedication at reoperation.

Clinical loosening

Three acetabular cups one metal (no 13) and two polyethylene cups (no 20, 44) loosened and were reoperated after 114 (Figs. 3-A, 3-B and 3-C) 65 and 35 months respectively. In one patient operated with a Howse Arden prosthesis (no 21) the femoral stem loosened and was replaced after 99 months. Gradually increasing pain at weight-bearing was the main reason for reoperation in these cases.

Clinical follow-up

The average clinical follow-up was 77 months (range 13-140 months). The shortest follow-up time was 24 months in the patients who were not reoperated (Table II). All but one (no 30) of the not reoperated patients were satisfied with the pain relief at follow-up. The grade of pain was on an average 2.7 points before the THR and at follow-up 5.3 points, all patients included (Table II). The range of movement increased from an average of 1.8 to 4.5 points but 22 hips were in class 1 before the THR (Table II) and nine of these were ankylotic. There was an average flexion contracture in 43 hips of 30 degrees (range 10-70) before the THR but only 6 degrees at follow-up (range 0-30). Compared with their hip mobility at discharge, the patients usually had the same or a better range of



Fig. 3-A.



Fig. 3-B.



Fig. 3-C.

Fig. 3-A. The McKee-Farrar prosthesis and adequate acetabular bone stock.

Fig. 3-B. Migration, protrusion and loosening of the cup. At the time of the revision arthroplasty there were three large perforations in the pelvis and an unhealed fracture of the posterior inferior part of the acetabulum.

Fig. 3-C. Bone from the iliac crest and an Eichler ring were used to build up a new acetabulum and a Lubinus prosthesis inserted.

flexion at follow-up. Even the patients with ankylosing spondylitis had the same range of motion at follow-up as when they left the hospital. Walking was only moderately improved due to multiple joint involvement (Table II), but the patients considered the improvement very important. Eight operations, including the THR, had been performed on average (range 2-26) at follow-up.

Nineteen of the patients had or tried to have an active sex-life before the arthroplasty but 16 had problems due to pain, stiffness or both. All but one were more satisfied with their sex-life after the THR due to the pain relief and/or better hip mobility. At follow up 13 patients were working, 11 patients had some kind of pension, seven patients were studying and two were housewives. The patients were on the average in ARA class 3.1 before the operation and in class 2.7 at follow-up.

All of the patients not reoperated were satisfied with the overall results of the THR at follow-up. Four (no 6, 13, 20, 21) of the six reoperated patients were satisfied with both the results of the primary THR and the revision and would have been willing to undergo a new THR under the same circumstances. One (no 39) was pleased with the results of the revision arthroplasty. The remaining reoperated patient (no 44) was dissatisfied with both the primary and the revision arthroplasty mainly due to poor range of motion.

Radiographic features

Thirty-seven hips were in stadium four (8 hips) or five (29 hips) preoperatively according to Larsen et al and of these, four were ankylotic. Three hips were in stadium three. Preoperative radiograms of four hips were not available and six hips had previously been operated with a Smith-Petersen cup. In 11 hips acetabular protrusion¹⁵ was present prior to THR and in six there were lateral subluxation of the femoral head. Thirty-seven of the acetabular cups were cemented within $45^{\circ} \pm 10$ degrees of latero version, six cups

Table II. Classification* of Pain, Range of movement and Walking Capacity in 50 THR's in 33 Patients

No of hips	Type of prosthesis**	Side	Follow-up months	Pain		Range of movement		Walking	
				Before operation	After operation	Follow-up	Before operation	Follow-up	Before operation
1	MKF	L	140	2	6	6	1	4	2
2	MKF	L	136	1	5	5	2	6	2
3	MKF	R	126	1	6	5	2	5	1
4	MKF	R	133	6	6	6	1	3	4
5	MKF	R	127	2	6	5	1	6	1
6	MKF	R	68	2	5	4	4	5	2
7	MKF	R	120	5	6	6	1	4	2
8	MKF	L	120	5	6	6	1	4	2
9	MKF	L	114	3	6	6	1	5	3
10	MKF	L	106	2	5	5	3	5	2
11	MKF	R	115	2	6	6	1	6	2
12	MKF	R	113	3	6	6	1	4	3
13	MKF	R	114	3	6	5	1	4	2
14	MKF	R	108	2	6	6	1	4	2
15	MKF	R	107	3	6	6	1	5	2
16	MKF	L	107	3	6	6	2	4	2
17	HM	L	107	5	5	5	3	3	1
18	MKF	L	102	2	5	5	2	4	2
19	MKF	L	103	2	6	5	2	6	2
20	HA	R	65	5	6	3	3	3	1
21	HA	R	99	1	6	3	4	4	1
22	HA	L	82	3	6	6	1	4	1
23	HA	R	84	4	6	6	1	4	1
24	H	L	84	6	6	6	1	5	3
25	HA	L	83	4	6	6	1	3	1

26	MKA	R	76	5	6	6	1	6	2	3
27	HA	L	74	1	6	6	2	5	1	2
28	HA	R	71	1	6	6	2	5	1	2
29	MKA	R	72	2	6	4	1	3	2	3
30	HA	R	65	2	6	4	3	6	2	3
31	HA	L	62	4	6	6	1	4	2	4
32	HA	L	63	2	6	5	3	5	2	3
33	HA	L	57	6	5	6	1	3	1	1
34	HA	R	59	4	6	6	2	4	2	4
35	B	L	56	2	5	5	2	6	2	3
36	MKA	R	54	2	6	6	2	5	2	4
37	MKA	L	51	2	6	6	2	5	2	4
38	MKA	R	51	2	6	6	2	5	2	4
39	MKA	L	13	2	4	2	4	5	3	3
40	HA	L	43	1	6	5	2	5	1	2
41	L	L	34	2	6	6	2	5	2	3
42	L	R	36	2	6	5	2	4	2	2
43	L	R	34	2	5	5	4	5	2	3
44	MKA	L	35	3	5	4	2	3	4	3
45	L	R	31	1	6	6	4	4	2	2
46	HA	R	30	1	6	6	1	4	1	1
47	HA	L	24	2	6	6	1	6	1	1
48	L	L	25	4	5	5	1	4	1	5
49	L	R	25	4	5	5	1	4	1	5
50	L	R	24	1	6	6	2	5	2	2
Average			77	2,7	5,7	5,3	1,8	4,5	1,9	2,8

* The classification of Merle d'Aubigné and Postel as modified by Charnley, see Table I.

** See surgical remarks

in more than 55 degrees and seven in less than 35 degrees. Four cups were cemented in retroversion. Radiolucent cement was used in the three first hips.

In three of the 11 hips (no 23, 27, 28) the initial protrusio increased slightly with time and one Howse Arden cup (no 23) was loose (2-5 mm zone) but painfree after 84 months. One of the hips (no 40, pain grade 5) had a 7 mm zone medially of the acetabular cup at 43 months. A Howse Arden cup had been used and the spongy bone of the femoral head transplanted to the acetabular wall. Of the six hips with lateral subluxation, one acetabular socket (no 20) and one femoral stem (no 21) had been replaced. Two acetabular sockets (no 17, 29) and one femoral stem (no 36) were radiographically loose at follow-up. One patient with lateral subluxation which was bilaterally operated had loosening on the left side (no 17) after 107 months and the other hip (no 20) had been previously replaced after 65 months. In one laterally subluxated hip (no 29) Chiari osteotomy was performed to create better bone support for the acetabular socket. McKee-Arden arthroplasty was carried out when the osteotomy had healed. There was a radiolucent zone and poor cement support laterally of the socket from the beginning, and the socket was loose at follow-up 72 months later. Periodically the patient has had a slight pain and the feeling of locking in the hip; he is waiting for reoperation. In one patient bilaterally operated with a McKee-Farrar prosthesis (no 6, 10) both components of the left side were loose (no 10) after 106 months. The cup had also migrated centrally. The patient is waiting for a reoperation. The other hip (no 6) was earlier reoperated because of infection.

Twenty-one of the femoral stems were cemented in varus, 16 in a neutral position and 13 in a valgus position. In 17 hips the cement did not cover the femoral stem distally and/or around the tip (16 hips) or proximally and medially (1 hip). The radiograms revealed radiolucent zones of more than 2 mm in five out of 15 hips

(infected hips excluded) with lack of cement cover around the femoral stem and one of these (no 21) was replaced because of symptomatic loosening. Thirteen of the 15 femoral stems were in varus. In one sufficiently cemented prosthesis out of 30 (no 36) the radiographs revealed a radiolucent zone of more than 2 mm proximally and laterally, and a cement fracture above the tip but the zone has been unchanged the last two years ($p < 0.05$). In three hips (no 27, 28, 30) all in varus with no cement cover laterally of the femoral tip, the stem had subsided at least 10 mm at follow-up after 74, 75, and 65 months respectively. One (no 30) had moderate pain (grade 4). In one hip (no 3) where radiolucent cement was used, the stem subsided 7 mm during the first six years but has been unchanged the last five years. Resorption of the femoral calcar (2-15 mm) was observed in six hips. In the hip with 15 mm of resorption the femoral stem was in varus from the beginning with no cement support medially.

Heterotopic ossification grade 3²⁹ was found in two hips (no 38, 44) and caused decreased motion in one hip (no 44). No correlation was found between previous hip surgery and radiographic loosening or reoperation. Small prosthesis custom-made for juvenile chronic arthritis were used in 16 hips. Of the 14 cases of clinical and radiographic loosening (infections excluded) eight concerned the small prosthesis ($p < 0.05$). Patients with radiographic loosening had on an average pain grade 5.2 at follow-up compared with 5.7 of the radiographic normal THR. Three patients with bilateral THR (6.10, 17.20, 27.28) had clinical or radiographic complications on both sides.

DISCUSSION

Most patients with JCA have a favourable prognosis¹³. Hip involvement is, however, common in those left with long-standing arthritis^{17, 28} and is the major cause of limited locomotion^{1, 17}.

The survival of THR was analysed by Dobbs and the results indicated that for metal-on-metal prosthesis the probability of survival was one third after 20 years and three fourths for metal-on-plastic. The predominant reason for failure was loosening and the annual reoperation rate tended to increase with time. Halley and Charnley speculated in 25-30 years of function before wear necessitates revision. One has to remember that although the ten-year result of THR is favourable this is only about one fourth of the expectation of life for a patient with JCA. Long-term results of revision arthroplasties due either to mechanical loosening or infections are not available for patients with either good or poor bone quality. Joint replacement will thus remain a controversial subject in JCA until more is known about the long-term results. The average follow-up of 77 months in our study is the longest reported for patients with JCA.

The clinical results in this study concerning pain relief (2.7 to 5.3 points), increased range of hip motion (1.8 to 4.5 points) (Table II) and decreased flexion contractures (30 to 6 degrees) were satisfactory. Although the gain in walking capacity was moderate (1.9 to 2.8 points) influenced by multiple joint involvement, the improvement was appreciated by the patients. On the average eight operations had been performed on the patients at follow-up. The quality of sex-life improved after the THR but the functional status was almost unchanged. This is in accordance with the observations of Baldursson.

Six hips had been reoperated (Fig. 1) two after infections, and

four because of loosening. The results after revision arthronlasty are promising so far. In ten hips there was radiographic loosening (Fig. 1) and two of these patients are waiting for reoperation. The number of reoperations and cases of radiographic loosening were more frequent in this study than reported by others^{1, 5, 9, 12, 19, 31, 32} but the follow-up time is also longer. Contrary to other reports previous hip surgery did not affect the loosening rate⁶ or the infection rate²⁷.

The varus position of the femoral stem was common (21/50) and more than half of the prosthesis in varus did not have a cement cover. There was a good correlation between lack of cement cover and radiographic loosening and this has also been reported earlier^{3, 6, 25, 26}. The grade of pain relief was lower (5.2 points compared with 5.7 points) in the group with radiographic loosening. The same observation was made by Beckenbaugh and Ilstrup 1978 and Carlsson and Gentz 1980. Five of the six hips with lateral subluxation prior to THR were loose clinically or radiographically. In three of these hips the acetabular socket was loose. It is of great importance to create good lateral support when the acetabulum is deficient. The femoral head can be used for this purpose as described by Harris et al.

We found a higher failure rate for small prosthesis. The cause could be related to the disease with poor bone quality. The skeletal size made it difficult to obtain a good position of the femoral stem and cement coverage. The prosthetic design with an acetabular snap-fit cup and the wedges of the femoral stem may contribute especially in combination with inadequate cement support. The technique of insertion and cementing has changed the last decade and with a new prosthetic design it is very likely that the results will be better in the future.

It is important to delay if possible THR for the youngest patients. Arthroscopy of the hip gives good information about the cartilage

and the synovial membrane and should be used early to decide whether or not synovectomy should be performed¹⁶. Synovectomy of the hip in JCA gives good pain relief for three fourths of the patients for several years and should always be considered before THR is carried out if the cartilage destruction is not great²⁴. Surface replacement has also recently been used with promising early clinical results in JCA²³. In the young patients with JCA where THR has to be performed, both the patient and the surgeon should be aware that although the short term results are satisfactory at least one revision arthroplasty will probably be necessary in the future mainly due to mechanical loosening.

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